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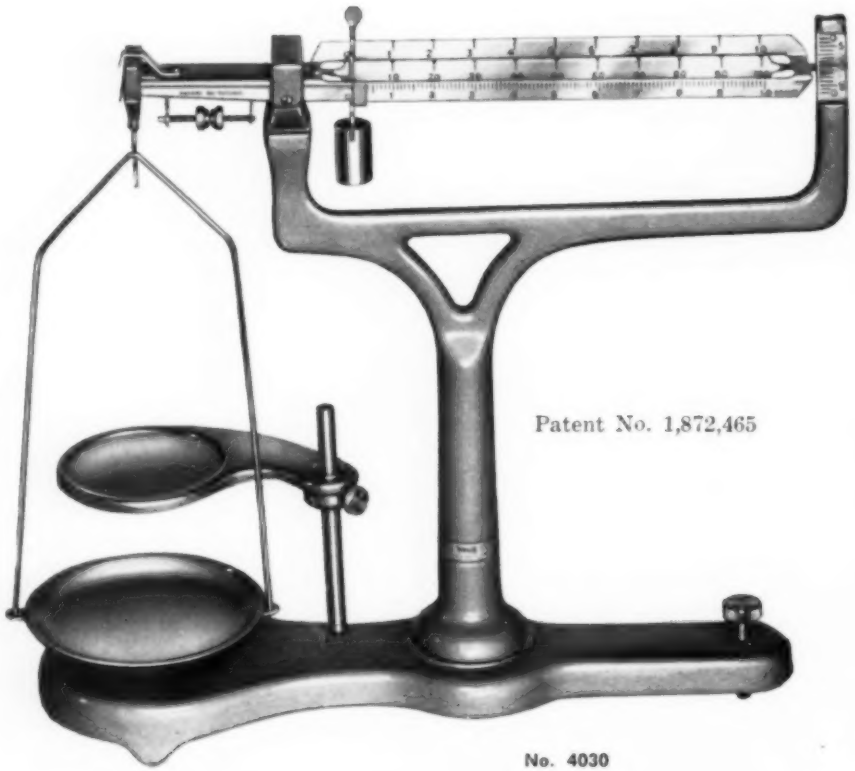

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Conservation of Hearing

By Thomas J. LePine, Assistant in Hearing Conservation, New York State Education Department, Albany, New York.

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A Functional Way of Teaching Physics

By O. A. Nelson, Principal, Wilson High School, St. Paul, Minnesota.

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Putting the Bugs to Work

By Joseph Bonnano, Medical and Pharmaceutical Information Bureau. New York, New York.

•

Writing a Nature Column

By Max Henrici, Nature Editor, Pittsburgh Sun-Telegraph, Pittsburgh, Pennsylvania.

An American Alchemist

By P. Schuyler Miller, Fisher Scientific Company, Pittsburgh, Pennsylvania.

•

Large Scale Production of Human Blood Derivatives

By J. R. Fisher, Associate Director of Blood Derivatives, Armour and Company, Kankakee, Illinois.

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Television—Today's Mirror

By Lynn Poole, T.V. Station WAAM, Baltimore, Maryland.

•

The Role of Tape

By Robert E. McCumber, Product Publicity Manager, Minnesota Mining and Manufacturing Company, Detroit, Michigan.

•

Acidity and Basicity in Organic Solvents

By Marion Maclean Davis, National Bureau of Standards, United States Department of Commerce, Washington, D. C.

An Experience in Nature Therapy

● **By Frances J. Gillotti, B.S.,** *(University of Massachusetts)*
EDUCATIONAL STAFF, MASSACHUSETTS AUDUBON SOCIETY, WORCESTER, MASSACHUSETTS

This article reports the worth-while results obtained by interesting mentally ill patients in an informal indoor and outdoor nature study program.

Nature Club activities provide a welcome break in hospital routine. The ever-changing program stimulates those who attend. Patients enter into discussions. They read between sessions. They gain self-confidence. The ill try to keep well enough to continue to attend the Club's sessions.

The pioneering work performed by Miss Gillotti on a wholly voluntary basis is worthy of emulation.

●

As the result of an illustrated talk on reptiles presented to a group of mentally ill patients at Westboro State Hospital one day, by a University of Massachusetts student, the idea of a nature project as a form of therapy was born. A suggestion concerning leadership aid, sent to the Massachusetts Audubon Society, resulted in my adopting the project on a voluntary basis, in spare moments from my regular duties of conducting a natural science and conservation course in the public schools.

A trip to the hospital brought information concerning a meeting place, the probable number of patients who might attend, the possibilities of showing films or using other kinds of visual aids, and the type of nature subjects or projects which should prove interesting and within the scope of understanding of the patients.

Miss Gillotti presents to the Nature Club "Roseann," a de-scented skunk from Cook's Canyon Wildlife Sanctuary, Barre, Mass.

The hospital's large auditorium served as the usual meeting place and rows of seats were moved into a semi-circular arrangement near the front of the hall so as to create an atmosphere of friendliness and informality. Attendance on the part of the patients was voluntary, as there were also occupational therapy projects or other club or recreational activities going on at the same time.

The Nature Club was a club in name only, as there were no officers. Usually, two members of the hospital's Recreation Department staff were present to escort patients to and from their living quarters, to make introductions, and to remain during the program.

The methods used in presenting the nature programs were varied. Always, the aim was to have the subject an interesting one, and one which would stimulate discussion. The audience was encouraged to ask questions at any time, and to tell about personal experiences or give additional bits of information. Visual aids in the form of charts, pictures, slides, films, mounted specimens, or actual materials, played an important part in the success of the program. Occasionally, live animals were shown.

A listing of some of the topics presented will give an indication of the type of subject which can be utilized for such a program.

Trees in Winter	Identifying Winter Birds
Massachusetts Mammals	Feeding Winter Birds
Weather	Our Vanishing Wildlife
Marine Life	Rocks and Minerals
Spring Birds	Winged Predators
Reptiles	Planetarium Program
Spring Wild Flowers	Outdoor Field Trips

An observation interesting to me, was the fact that many of the patients who attended the meetings regularly could remember much of the material presented to them. A vivid illustration of this occurred at the beginning of the second series of programs. Between February 6, 1951, when the nature project was first begun, and May 14, 1951, ten meetings were held. Summer duties took me away from Massachusetts, and nature programs were not resumed at Westboro State Hospital until November 12, 1951. As we sat in the auditorium that November day, waiting for some of the late-comers to arrive, we talked about the preceding summer and spring. Some of the patients mentioned their gratitude that the Nature Club was to continue, as they had missed having the meetings all summer. They surprised me with accurate accounts of our former winter and spring discussions! The idea had occurred to me that with several new patients attending the meetings it might be advisable to repeat some of the subjects presented at earlier meetings. But that idea was immediately dropped from my planning schedule after I discovered that some of the patients who attended most regularly could remember our discussions so well. While it seemed too bad to have the new patients lose out on the earlier topics, it was not advisable to have a repetition for the patients who were present most often.

A second observation was that the patients enjoyed a great deal of variety in the subjects treated. Some topics were carried over to a subsequent meeting for

(Continued on Page 68)

Science in Shirtsleeves

• By Vaughan Garwood
STAFF WRITER, CARNEGIE MUSEUM, PITTSBURGH, PENNSYLVANIA

What happens back stage in a museum? Would people like to know?

These questions have been answered by the Carnegie Museum of Pittsburgh in its current successful exhibition in which the usually anonymous artists and preparators are the stars of the show.

This is a story of another way in which museums may develop a closer relationship with the people.

●

"Are those eyes *real*?" asks the visitor in the exhibition hall, inspecting a mounted specimen of an eagle, or it might be a black bear.

"No, ma'am," the guard replies with practised nonchalance. "They're artificial—made of glass."

By what dark wizardry people suppose an animal's natural eyes could be preserved for exhibition is a perennial mystery. Yet the question is asked in all seriousness. So are the occasional posers, like "Where do you keep the genuine replicas?" A museum may either shrug an official shoulder at such naiveté or find in it a challenge to throw aside formality by inviting the public behind scenes, where science takes off its coat and gets its hands dirty. Pittsburgh's Carnegie Museum, having accepted the challenge, is now responding with a novel exhibition in which preparators and artists, the forgotten men of museology, become the stars of the show.

"MUSEUM BACKSTAGE," opened last October for a year's run, occupies a roughly circular gallery with a cruciform central structure comprising two large mural panels, two deep recesses, and eight flanking shadowboxes. Artists' sketches, layouts, and paintings are ranged around the periphery, while the core of the room is given over to preparators' work in three dimensions. The material displayed was selected by each contributor as representative of his particular forte. Since most of the exhibits speak for themselves, labeling has been held to a minimum except in how-to-do-it sequences accompanying demonstrations of laboratory techniques and in thumbnail biographies appended to photographs of the contributors at work.

Six pairs of faceless but otherwise lifelike glass eyes for use in bird and mammal taxidermy peer out from the shadowbox of G. A. Link, Jr., who for the past forty years has run the gamut of preparational assignments at the Museum, as his father did before him. Besides setting visitors to rights on the eye question, Mr. Link also exhibits a turkey head made of rubber, a scale model of an entombed Egyptian mummy, and a papier-mâché rock only experts can tell from the real thing.

Waxwork and blown glass are the special province of Hanne von Fuehrer, who shows examples of models made for large habitat dioramas and for detailed study groups. In the first display are lifesize wax replicas of dogwood and cotton plants together with plaster casts used in their fabrication, which is done leaf by leaf and petal by petal, not wholesale as many laymen imagine. The second contains models of flowers and insects enlarged twenty times to reveal minute structural features indistinguishable in the original specimens.

The diametrically opposed problem of reproducing big things on a small scale is solved by Harold J. Clement in a series of North American mammal models one-sixth life size, recently completed as part of a projected permanent exhibition. Field photographs, notes of body measurements and a half-finished model are included to give some idea of how the sculptor goes about capturing the essential character of a living animal.

In an adjoining exhibit Robert Caffrey demonstrates the use of liquid latex to obtain accurate impressions of specimens as different in form and texture as a piece of sandstone and a dinosaur jaw. Originated at Carnegie Museum by Chief Staff Artist Ottmar von Fuehrer, this versatile technique makes it possible to reproduce down to the final detail unique and often

(Continued on Page 68)

IN SHADOWBOX ON LEFT, fossil vertebrate specimens as received from the field and in three stages of preparation. In background, sketches and designs for Museum publications by two staff artists.

Wind Generated Electricity for Desert Areas

• By E. W. Golding, M.Sc.Tech., M.I.E.E., Mem. Amer. I.E.E.
HEAD OF THE RURAL ELECTRIFICATION AND WIND POWER DEPARTMENT, ELECTRICAL RESEARCH ASSOCIATION, SAVOY PLACE, LONDON, W. C. 2

The topography of Israel is such that under present conditions electricity cannot be supplied economically to rather extensive areas. Wind-driven generators, if suitable sites could be found, could make a useful contribution in saving expensive fuel and in providing electricity at points where alternative sources are not practicable.

This article is a most interesting report of the studies now being made in Israel by Mr. Golding, under the sponsorship of UNESCO, to determine if and where sufficient wind power is available in certain regions.

●

About one-third of the land surface of the earth is included in the arid zones—too great a proportion to be allowed to remain entirely uncultivated if the rapidly increasing population of the world is to be fed.

There are five main arid zones in which the climate varies from the extreme arid, with at least twelve consecutive rainless months, through the arid, which is too dry for the production of crops, to the semi-arid where certain types of crops can be grown. These zones are: (*a*) the North African and Eurasian belt, stretching from North West Africa, through the Middle East to Mongolia; (*b*) central Australia; (*c*) the Western United States and Mexico; (*d*) the Western Coastal strip in South America; and (*e*) South West Africa.

Each zone has a central core of desert created by centuries of near-drought and, in some cases, enlarged and aggravated by man's unwise use of such vegetation as once existed there. There are also the "cold deserts" in the Arctic and Antarctic regions but their development presents a different problem. We are concerned here with the hot, dry deserts which are often not inherently infertile and which, given an adequate supply of water, could be made to produce food crops satisfactorily, or even in abundant quantities. Water is therefore a pre-requisite for desert development and must be supplied either from outside the area, through a system of water pipes and pumping stations, or from local underground sources, if these exist.

The Need for Energy

Second only in importance to water is a supply of energy which is essential to augment human efforts in developing the land and also to provide amenities rendering life bearable by the settlers who must be relied upon to do the work of reclamation. Such pioneers will doubtless be prepared to exist under somewhat primitive conditions in the early stages of the desert development but, nevertheless, a reasonable standard of living must be afforded if the work is to be carried on effectively.

How is this very necessary energy to be supplied? It could be imported in the form of fuel, probably oil, to feed local thermally-driven power plants, or as electrical energy brought in by transmission lines from power stations outside the desert area. Either of these alternatives is likely to prove very expensive owing to the great distances and difficult routes which may have to be traversed.

We turn, then, to a consideration of the possible sources of energy to be found locally in the deserts themselves. There are rare occurrences of fuels as, for example, at Kenadsa in Algeria where there is a coal mine; bituminous limestone and buried peat deposits have been found elsewhere. A little water power could, perhaps, be developed at a few widely scattered points. But, in the main the only local sources of energy which could possibly be developed are solar energy and wind energy.

Solar and Wind Energy

Solar radiation, giving energy to the earth at a rate of up to 1 kilowatt per square metre of surface (normal to the rays), contributes enormous total amounts of energy during the daytime in most desert areas, but this is not easy to collect and to convert into the other forms of energy which are needed. Research work on the utilization of solar radiation continues and one or two useful devices, such as solar water heaters and a solar cooker, have been introduced but development of this form of energy on a wider scale may be slow.

Wind-driven machines for the direct drive of water pumps have been used in many parts of the world for years and, within the last two decades, small wind-driven generators for electricity supply to isolated premises have been placed on the market. These units, of individual capacities up to about 2 kilowatts, have been widely adopted and have certainly proved to be a satisfactory source of power for limited uses, particularly for lighting and small-power domestic purposes. During and since World War II efforts have been made to develop larger wind-driven generators, starting with plants in the range 10 to 100 kilowatts and leading to the eventual construction of large units having a capacity of perhaps 3000 to 4000 kW. The latter will be for connection to public utility networks into which they will feed their output directly, without any form of storage. The smaller plants mentioned are intended for electricity supply on farms or for communities on islands and in desert and other remote areas. Some, of about 10 kW capacity, are now becoming commercially available in Great Britain, France and Germany and their application to the needs of desert dwellers is being studied.

Wind Regimes

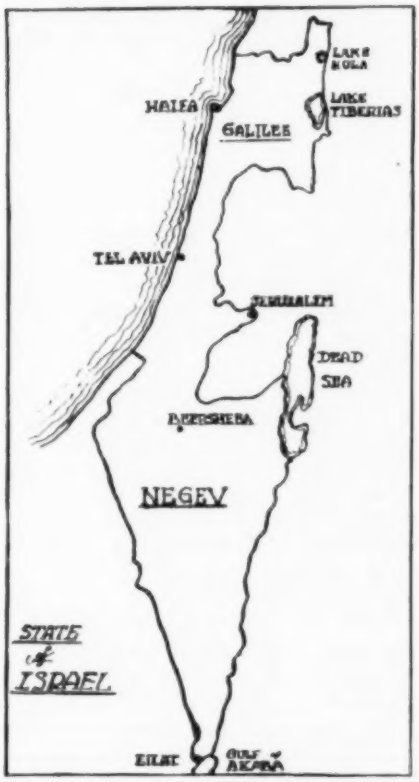
Wind speeds in the extensive arid zones of the world will, of course, vary considerably from place to place. The winds there may seldom be very strong and their occurrence may not be predictable with much precision; but if it can be shown from meteorological records that winds do occur fairly regularly during each year it is proof that energy from this source is available. Relatively low wind speeds are a handicap only in that they demand a larger, and therefore more expensive, rotor to produce a given power than would be needed at a windier place. But the higher cost can probably be incurred economically when alternative means of power generation are so expensive. High wind speeds with correspondingly cheap plant capacity, are only essential when wind power is in competition with cheaply-produced energy from coal or water power. Nevertheless, it is very important to select sites for the installation of desert wind power plants with care to ensure that the maximum possible wind speeds can be tapped.

Wind Power for Israel

The above review has been given to provide a background to a brief account of the writer's recent visits to Israel. These, under the sponsorship of UNESCO, were to advise the Israeli Government, through its Research Council, of the possibilities of using wind power in that country and on the investigations which should be made to determine the probable energy outputs obtainable from wind-driven machines located in different districts.

The State of Israel has an area of 8048 square miles and a present population approaching two million, but which is rapidly growing to the 2.5 million envisaged in the primary phase of development. The country, with a total length, north to south, of about 250 miles, is very irregularly shaped. It has, in the north, Galilee with its hills (up to more than 4000 feet high), and fertile valleys, particularly the wide valley of Esdraelon. The Mount Carmel area, inland from Haifa, with its hills and vineyards, divides Galilee from the narrow, well cultivated, coastal strip running south to the tongue which extends east, through the hills of Judea, to Jerusalem. Further south the coastal area widens and finally opens into the wide northern end of the Negev, a triangular-shaped desert, or semi-desert, region occupying about half the total area of Israel and stretching down to its southern apex at Eilat on the Gulf of Akaba.

In the Negev the annual rainfall varies from just under 1 inch at Eilat to about 9 inches at Beersheba, although that in the northern part of the country rises to some 28 inches. It is estimated that about 500,000 Israelis will be engaged in intensive irrigated farming so that an ample water supply, especially in the south, is a prime necessity. The Negev, which has considerable mineral resources—copper, manganese, iron, phosphates, kaolin and glass sands—must be developed to feed one of the new industrial centres being established at Beersheba. In Galilee, Judea and the coastal belts are many agricultural settlements which are an important factor in the country's economy.



Electric power is supplied through distribution networks from the two main power stations at Haifa and Tel Aviv, but these are very distant from the Negev in which the population, even when the area is developed, will be very scattered so that electricity distribution there would be expensive. Generation in the power stations is almost entirely from oil so that costs are high. (The abundance of oil in adjacent countries does not reduce its cost in Israel.)

Wind power, if favourable sites can be found, could make—through large wind-driven plants—a very useful contribution, as a fuel saver, in connection with the main electricity networks in the north and centre. It could serve a similar purpose, through small and medium-size plants of up to 10 or 20 kilowatts capacity, at the agricultural settlements which often have their own small generating stations. At new settlements in the southern, semi-desert, area of the Negev, wind power could be especially beneficial in providing a local source of power where the only practicable alternative is Diesel generation from oil imported over long distances by difficult roads. Non-electric windmills for water pumping should prove useful in most parts of the country.

Some estimates which the writer made indicated that, with a windmill having a 50 ft. diameter rotor located at a site having a mean annual wind speed of 12.5 miles per hour, some 55 kilowatts could be produced, giving a total annual output of about 104,000 kilowatt-hours of energy. This would be sufficient, for example, to supply the lighting and small-power domestic needs of a desert community of about 100 families, as well

as providing water heating, water pumping, and some refrigeration. Developments of wind-driven plants near this size in Great Britain, France, Germany and Denmark point to a price of about £200 per kilowatt so that, with capital charges for interest, and depreciation of 10 per cent, the generating cost would be of the order of 3 pence per kilowatt-hour which could not be regarded as uneconomic.

At a later stage of development, when communities have been able to establish some agriculture, purposes such as grinding, fodder chopping or silage cutting, poultry house lighting, manure pumping and additional water pumping for irrigation might be served by wind power.

To determine wind power potentialities in the different parts of a country varying so widely climatically and topographically, wind measurements on specially selected sites must be made. Some measurements have been made already, during past years, by the Israeli meteorological service at well distributed observation stations, but these stations have not been chosen for their especial windiness. Hence, their annual average wind speeds seldom exceed 11 miles per hour. But experience with an extensive wind survey in Great Britain has shown that by choosing fairly steep, but smoothly shaped, hills which are not screened from the prevailing winds by adjacent high ground, sites can be found, on their summits, where the average wind speed is fifty to one hundred per cent higher than that for the surrounding district. There is no reason to think that this would not be true in Israel also.

Such hills were therefore sought, and found, in each of the four areas into which the country can be divided for this purpose, namely, Galilee, the coastal belt, the Judea hills, and the Negev.

The mean hourly wind speeds throughout the year are needed for a velocity-duration curve to be plotted so that this can be used to estimate the annual energy output from a wind-driven machine of given design. Hourly speeds can be obtained from a cup anemometer of the electrical contact type mounted on a light, 30-foot high pole. The anemometer gives an impulse, in a battery-operated circuit, for the passage of each one-twentieth mile of wind. The impulses are integrated by a summator mechanism in recorders built, for the purpose of their wind survey, by the Electrical Research Association in Great Britain. In these, for every two miles of wind, a dot is made on a clockwork-driven chart marked in hours. The hourly wind speeds are then obtained by counting the dots during each hourly run on the chart, which is changed once a week.

Since, however, these recorders are not cheap, and it was the writer's intention that the maximum possible information should be gained from the instruments to be purchased with the funds made available by UNESCO, simpler instruments were recommended for twelve of the sixteen sites chosen. These were anemometers of the counter type giving miles of wind passing during the weekly period between readings, and mounted on 10 ft. poles so that they can be read, from ground level, by local observers.

One recorder was allocated to a typical, good hill in each of the four areas and, as the wind regimes for hills in the same area are not likely to differ widely, the readings from the simple counter anemometers can be used to estimate, with fair accuracy, the velocity duration curves for the sites on which they are placed.

As a check on the measurements and to relate integrated values to instantaneous wind speeds, it was recommended that one Dines pressure-tube anemometer —a much more elaborate instrument which can be used as a standard—should be installed at one site alongside a cup counter anemometer. The site chosen for this was Eilat where a small meteorological station was already in being so that skilled attention could be provided.

The 16 measuring sites were chosen on hills varying in altitude from about 50 ft. above sea level to 3100 ft. (on Mount Kinan). Many of them were close to villages, which, in Israel, are often found on or near the summits of hills, to ensure some supervision and to facilitate the taking of frequent readings. At one place in the Negev, on a plateau at an altitude of 1600 feet, one anemometer is to be placed at the foot, and another at the summit of a small hill to determine the advantage which may be gained from a slight eminence on high flat ground.

This brief summary outlines the means whereby, a fair indication of the wind regimes for favourable sites spread over the whole country may be obtained from the readings, over a period of perhaps one to two years, of 16 or 17 instruments.

Experimental Utilization of Wind Power

It was also recommended that, in addition to wind measurements, four or five small wind-driven generators should be installed and operated at isolated houses or in communities. Performance tests can be made on them, using specified electrical instruments to be supplied by UNESCO, and experience will be gained which should give an indication of their possibilities and of the problems which may be presented in their more extensive adoption. A further suggestion was made that the way of life of the inhabitants of some of the newly established communities in the Negev should be studied in sufficient detail for their energy requirements to be estimated. Wind power plants of suitable size can be installed later, accompanied by adequate facilities for energy storage to cover calm spells. ●

★ ★ ★ ★ ★

The frontiers of science excite the student because they take him to the edge of what is known and enable him to see the attack on the unknown as it is actually being waged, and also because the student feels that at last he is face to face with the science of his own time, the science that he reads about in the newspapers or hears about on the radio. It must not be forgotten that the student's excitement also mirrors the enthusiasm of the teacher who himself does not find the theory of the inclined plane as interesting as relativity.

—I. BERNARD COHEN
Harvard University

At the Sign of the Turtox

● By A. C. Lonert
DIRECTOR OF RESEARCH—THE GENERAL BIOLOGICAL SUPPLY HOUSE, INC., CHICAGO, ILLINOIS

Every teacher of biology knows and respects the name Turtox.

But not all are aware of how the Turtox organization came into being, of the policies under which it is conducted, or of the amazing variety of materials it processes. Few realize the importance of its scientific staff and the work they do.

You will find this an interesting story.

●

This is the story of the General Biological Supply House, a unique organization with an unusual service ideal. Its trade name, Turtox, has become synonymous in the minds of thousands of teachers with the best in teaching helps and materials, both living and preserved, covering every phase of biology, regardless of seasonal, climatic, or geographical barriers.

Our account begins in 1914 with Morris M. Wells, who was at that time a graduate student in the zoology department at the University of Chicago. In the course of his work he was keenly impressed with the lack of a commercial supply source for biological materials, and when a staff member suggested to him that he make microscope slide preparations in his spare time, to supply much-needed class material, the good ship "Turtox" was unknowingly launched in a little makeshift basement laboratory.

The following year, 1915, Doctor Wells received his Ph.D. and became a zoology instructor. With the help of his bride of only six months (an excellent technician), the Turtox line was expanded to include preserved materials and other items. Within a few years, the demand for Turtox products had grown to such a volume that the services of several employees were required, and Doctor Wells felt he must devote his full time to the rapidly growing biological mail-order house, although he was reluctant to leave the teaching field. It was only natural that some of his associates were critical of this move, but in later years, when the results of the choice became evident, the critics freely admitted that the commercial venture really had developed into an invaluable contribution to the biological teaching profession.

Doctor Wells, an unassuming man of vision, possessed a real passion for the advancement of biology, and his primary interest lay in helping the teacher to stimulate learning by providing actual specimens, alive or preserved, for the classroom. Because of his own teaching experience, he was well qualified to know what needs existed, and he worked tirelessly to effect improvements. Doctor Wells had the happy faculty of charging those around him with his own enthusiasm, so there began to issue from Turtox free and helpful informational bulletins, the *Turtox Service Leaflets* and *Turtox News* (a monthly publication, originated in 1923). Before his untimely death in 1930, Doctor Wells proceeded with the incorporation of the General Biological Supply House; the Marine Biological Laboratory (a non-profit organization) of Woods Hole, Massachusetts, holding 51 per cent of the voting stock. This arrangement was made to insure a control of the policies of the General Biological Supply House through the coming years by an institution dedicated to the interests of the biological sciences.

How well the aims of its founder have been realized can be seen in the General Biological Supply House of today, the house with an academic atmosphere. *Turtox News* continues to be published monthly without fail, functioning as a sounding board for biologists to facilitate the exchange of ideas, and carrying informational contributions from the Turtox staff. *Turtox News* is mailed without charge to over 50,000 teachers, and it

MOUNTED CAT SKELETONS produced in the Turtox Museum Preparations Department.

is the only Turtox representative in the field—except for its products and catalogs.

What authors think of *Turtox News* can be gathered from a statement by a well known botanist who sent in a short paper—accompanying it with a letter in which he said: "I hope that you will be willing to publish it in *Turtox News*, since there it will be surer to come to the attention both of college and secondary school biologists than in any other publication." The *Turtox Service Leaflets* have been expanded in number from the original 6 to 55, covering as many different subjects. These leaflets answer hundreds of questions for the biology teacher and offer much valuable and condensed information not readily found in the average biology textbook. They are used in thousands of schools and are required student reading in nearly all teachers' colleges. All of the *Turtox Service Leaflets* are offered free to teachers and school officials. An entire set of 55 can be secured gratis on request. (The leaflets are made available at actual cost for distribution to students.)

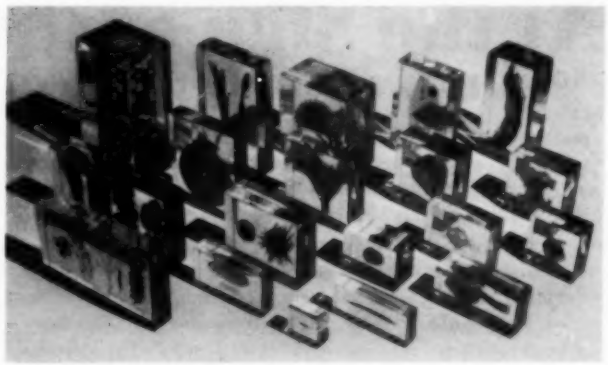
Even the Turtox catalog is highly prized for the great amount of instructional material it contains. The hundreds of original photomicrographs and photographs used as illustrations are in constant demand by textbook authors. Many copyrighted Turtox pictures and drawings have been published in dozens of outstanding biology texts. (No charge is made to authors or publishers for this service.)

An idea of what the company catalog means to its recipients is expressed to us in a multitude of letters; a cross-section of these might well be conveyed by the following quotations: "You certainly are to be congratulated upon putting out a volume of the kind this is—it is more than a catalog; a veritable encyclopedia of information in Biology." "The whole (catalog) would serve as an excellent supplementary textbook for students studying zoology, or most any phase of biology, in that so many of the specimens are more beautifully illustrated than in many a textbook."

One of the results of the Turtox service policy has been the building up of a staff of trained biologists, each of whom is a specialist in his own particular field. Most of the staff members have also had experience as biology teachers; they are, therefore, well able to appreciate the teacher's view-point, and to use this knowledge in a constant striving to improve materials and methods.

Through a world-wide field collecting organization, Turtox secures products which are used in numerous educational institutions, hospitals, and research laboratories. Research workers are invited to make use of Turtox research service whenever rare or unusual items are needed for their problems. The service is gratis and such materials are furnished at cost. If the specimens cannot be secured through its collecting organization, notes are inserted in *Turtox News* calling the attention of other biologists to the need.

To give the reader some idea of what goes on behind the scenes at Turtox, a short inspection tour of the plant may prove interesting. On entering the Preserved Materials Department, the visitor is impressed with



Turtox Plastic Embedments

the vistas of barrels and drums, all containing preserved animal specimens for dissection; the stock generally consists of starfish, sea urchins, loligo, dogfish, necturus, grassfrogs, large turtles, pig embryos, etc. Space is usually at a premium because of daily incoming shipments of various living specimens; this is especially true when consignments of thousands of giant lubber grasshoppers arrive! Just beyond, in a small room, a technician may be busily engaged in removing and preserving brains from the heads of freshly slaughtered sheep, an arduous and painstaking operation requiring considerable know-how.

Continuing along into the embalming room, one sees cats in the process of being dry-embalmed, and nearly always there are large numbers of living crayfish, iced perch, or clams ready for preservation treatment. (Teachers have actually reported finding pearls in some of these clams.) The expert injectionists of the department are continually at work injecting blood vessels of preserved cats, or freshly killed rats, frogs, or necturus with colored latex. The injected vessels make the problem of demonstrating the vascular system a fascinating one for class-room dissection. Freshly killed specimens are also injected with Vinylite solution; when these are subsequently treated with corrosive acid, three-dimensional casts of the vascular systems result, differentiated by color into arteries, veins, etc. Some of the vascular casts are mounted in jars by the Museum Preparations Department and others are sent to the Plastics Division for embedment. (The injection procedure requires considerable skill. Much research has gone into the development of suitable injection media and pigments.)

In the next room, shelves are stocked with many kinds of small preserved animal specimens neatly arranged according to phyla. There are all sorts of objects here which are seldom seen except as textbook illustrations. A reputation for thoroughness and expert technique has caused many of the larger museums and research institutions to depend on this department for special dry-embalming and injecting of rare specimens. The staff is called upon frequently to prepare valuable animals for exacting dissections. Out-of-the-ordinary animals embalmed and injected in the Preserved Materials Department include the giraffe (young speci-

(Continued on Page 76)

A Desert Island in the Arctic

• **By Pierre Dansereau, D.Sc.,** *(University of Geneva)*
ASSOCIATE PROFESSOR OF BOTANY, UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN

You cannot afford to miss this opportunity to join a distinguished botanist at work in the Arctic.

This intimate account of the experiences of three days is composed of notes extracted from a journal kept by Dr. Dansereau as a member of the Baird Expedition to Baffin Island in 1950. (For general report see P. D. Baird, in "ARCTIC," 3:131-149, 1950; "CANADIAN GEOGRAPHICAL JOURNAL," 42:212-223, 1951; and "GEOGRAPHICAL JOURNAL," 118(3):267-279, 1952.)

In this narrative, "Pat" is Col. P. D. Baird, leader of the expedition; "Dick" is Professor Richard P. Goldthwait, geologist, of Ohio State University; and "Maury" is Maurice King, the Expedition's pilot, who died in unknown circumstances off the coast of Alaska in 1951. "Svenn" is S. Orvig, of the Arctic Institute. The areas described lie very slightly north and south of 70° Lat. N in Baffin Island.

●

August 8th, 1950. CLYDE.

A fine, late-summer day. The wet tundra around the settlement has lost the olive tinge it briefly held in late July. The small amount of yearly growth of the sedges and the persistence of several years' dead leaves at their bases gives the whole landscape a brownish hue. The melting mud around the buildings flows in small rivulets among the boulders. The Eskimo workers are busily spreading huge polar bear skins on the dry gravel of the beach.

The bay, at last free of ice floes, is a deep blue as our small Norseman plane takes off into the glaring sky. Small strips of snow remain encased in the folds of the low hills. This coastal zone is flat and monotonous. At fifteen-hundred feet the shallow lakes and ponds are a dull steely blue, rimmed with coarse pink gravel. Extensive bouldery flats and low ridges look bare of vegetation, except on ravine edges where the reddish heaths are denser.

Beyond Ayr Lake rises the mountain range that runs parallel to the coast and through which the great Pleistocene glaciers have cut deep fiords. Even now extensive ice fields cover many of the high plateaus, and ice tongues extend down the valleys to sea level. These solid rivers, in their slow movement, carry mud, gravel and boulders. They become covered with a snow that melts in the summer and exposes the raw, blue, cracking ice. Rivulets swelling into streams channel their surface and polish their edges. Some peaks, like the Cockscomb, pierce the ice mantle with their sharp, red needles and crests. Smooth vertical cliffs are streaked with firmly encrusted algae.

Our small craft taxies down the fiord, now in the shade of walls of gneiss, now above a shining field of snow. And presently we have reached the head of Gibbs Fiord and the plane eases down to sea level, the pontoons biting firmly into the hard surface of the water. We come to a slow stop on the low sand beach that terminates a broad outwash plain where a succession of long terraces mark former levels.

Dick has been studying the geological evolution of these terraces, has been living out here for two weeks now, his only companion a fox that comes prowling around his provision boxes.

August 9th. BRAY ISLAND.

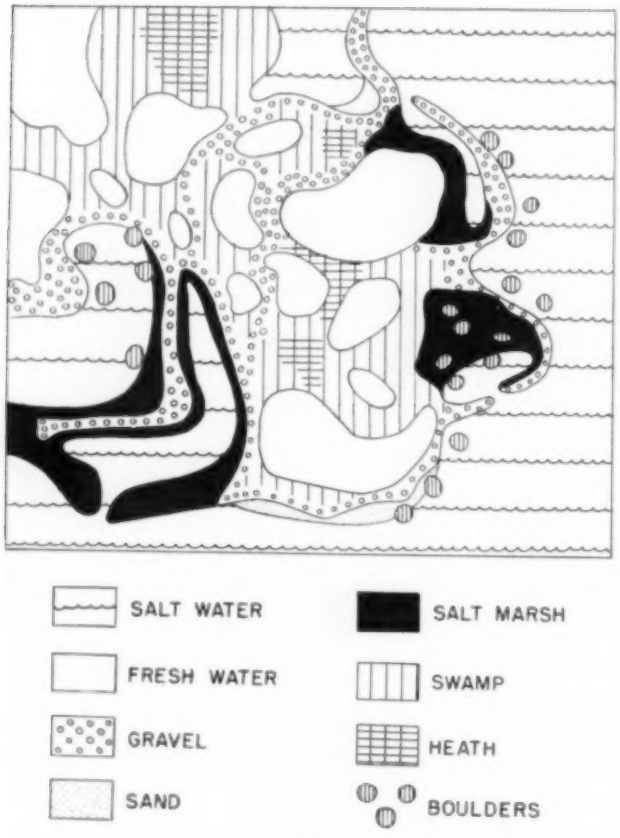
It seems as though we have come a long way today, although actually it was little more than a hundred miles.

Last night we rolled up in our bags on the beach of Gibbs Fiord, and slept very well. The mosquitoes have practically all ceased to be active. Come to think of it, there is night now! Just recently, the perpetual daylight has begun to dim around midnight, and there is then a brief dusk. Deep still tranquillity. It is new and somewhat ominous.

Our take-off this morning was difficult, as we were heavily loaded and there was no wind. We had to try many times. Wait for wind. Frantically tear the surface of the water. Return gently to shore. Try again. Unload part of the gasoline. Lighter, we rise and soar above the softly rolling plateau at the head of the fiord. Small dull blue lakes again. Swift streams, some with crumbling snow bridges over them.

And now the Barnes Ice Cap. A mass of gleaming ice nearly a hundred miles long and fifteen to thirty miles wide, it has overwhelmed quite a varied topography. Streams flow out of it and down open, pre-

THE EASTERN TIP of Bray Island, from the air. The low limestone strands enclose freshwater lakes bordered by dark marshy depressions. The silted inlets harbour grassy salt-marshes.



A GENERALIZED SKETCH of habitats on Bray Island.

glacial valleys to the sea. Where it has uncovered higher hills, water runs back against this gigantic dam and lakes well up along its sides, erode the ice and form towers and cliffs.

We fly across the top. Some fifteen hundred feet of ice overlie the bedrock. We swing low over Camp A and drop provisions and messages to our hardy meteorologist, Svenn, who has been there for about seventy-five consecutive days now. Talk about learning the ways of the weather! He will never know that there was a summer in 1950. He waves up at us, his gestures wonderfully expressive against the desolate field of cold.

The landscape to the west is not very different from the eastern hinterland. The waters of two pre-glacial valleys join before they flow into Lake Gillian, their brown and greenish sediments distinct at the junction. (Like those of the Amazon and the Rio Negro. Did I complain of the heat then? Do I really mind the cold, now?)

We descend briefly on Lake Gillian and come to a bobbing stop on the rough water against the boulders of the shore. The lovely fragrant fern is quite abundant here on the black lichen-encrusted scree. Its crowns of finely dissected foliage nestle in a furry growth of mosses. A small area of active dunes harbours leguminous plants not seen on the east coast or in the interior. A few yellow butterflies that feed upon them flit uneasily in the grazing wind. Some Low Arctic plants have also taken refuge here: a lovely silvery-gray lichen, until now unknown in the Arctic Archipelago, and the red-leaved arctic bearberry lie scattered among the browning heath.

In the late afternoon we took off again to the west, over Foxe Basin. Baird Peninsula is visible to the south, and several small islands to the north and west. One of them is Bray Island named for Bray, the ornithologist who lost his life during an expedition in this area in the thirties.

As we fly down, we can see that the island barely rises above sea level. The icebergs that drift around it seem to be as high as its gravel ridges. Dick says its emergence from the sea may be so recent that the early explorers one-hundred years ago will not have seen it. And now it looks like a sprawling stone net with uneven stitches and loops. The rigid framework is a dull-olive gravel extending in thin strands and shallow terraces. Here and there it encloses the bright medallion of a freshwater pond. The shallow intertidal zone that penetrates the whole network is bright red with the blades of a saltmarsh grass, whereas the inland freshwater swamp is greenish and yellow. The ivory patches of snow lichen are large enough to be seen from the air.

We circle round and round and dip down repeatedly quite close to the surface. A frightened flock of ducks takes off from a pond at our approach. None of these inland waters are large enough for us to alight upon. The shores, on the other hand, are shallow and strewn with boulders. Also, a swift current swishes around the island, carrying sharp ice floes. It is difficult to come down on the open water, taxi in through the boulders and rest our pontoons on the gently sloping beach. Maury is almost ready to give up and fly back to the mainland. We are disappointed, having anticipated the pleasure of being the first non-Eskimo to land here. Dick thinks these schists to be Paleozoic limestone and would like to get a collection of fossils. I am very much intrigued myself by the vegetation: what are those big reddish rosettes that dot the strands? What grows in the marshes through that peaty

THE EVEN scattering of saxifrage cushions on the raw schists of the strand. The Baffin mainland in the background, with ice floes drifting in the middle ground.

turf? I do not think I have seen anything quite like this on the mainland.

Maury suddenly takes a veering and we fly quite close to the water (our antennae quivering), above the swiftly drifting floes, inches away from large boulders. The water seems to be deep enough when our pontoons plough through it. Almost before we know it, the nose of the plane is turned up as we rest snugly on the beach. Maury says we may have an hour to explore before the tide begins to recede.

The total diameter of the island must be something less than two miles. But no straight course is possible: the sea channels thrust in to the very centre and the lakes have to be walked around. It is possible, however, to find a great variety of habitats nearby. Pat sets off at his seven-leagues' pace to find the highest point. Dick and I keep our noses to the ground for fossils and living plants. I collect these madly at first, stuff them away in my press, and make quick sketches of habitat conditions.

The limestone *is* Paleozoic, contains Brachiopods and Trilobites. The large flat flagstones break easily into flakes and needles and are accumulated in places to an apparent depth of several feet.

Our presence stirs a loud protest from the Arctic terns who fly excitedly about and repeatedly plunge down upon us menacingly. The fanciful weave of their flight is in strong contrast to the horizontal purposeful course of the ducks.

It is now an hour later. We have resignedly come back to the plane. And there is great rejoicing because the sea has gone out and we are left stranded and will have to stay here many more hours. Maury greets the occasion with a few perfunctory swear words and then takes off happily to the pond where a dozen unsuspecting ducks are lazily swimming.

August 10th. BRAY ISLAND.

It was about 8 o'clock last night when we discovered that the Norseman was grounded. So we got the Primus stove going in the lee of a boulder and cooked some sliced beef and gulped down some hardtack and washed it off with Nescafé, and went about our business.

We now had to count with a light fog that was settling about us, and we could not stray too far off in this maze of narrow ridges. Dick and I wandered away, following a long gravel crest, exploring to the right and left of us. At times I could hardly see him, only hear the flapping of his raincoat in the wind, the jingle of stones as he threw them in a canvas bag, the thud of his hammer. I pulled up roots and measured them and recorded the density of grasses and sedges, the thickness of lichens, on the moist pages of my notebook. The precarious texture of these familiar leaves and stems somehow seemed new to my hands as I felt them.

The terns were silent now, and the quiet and the enveloping wetness, the softness of the wind more than the increased difficulty of observing and writing made us conscious of the dusk. We had to bend very low to find our stones and pick our plants. We made slow, co-ordinated movements from place to place. We could see only a few yards ahead, but it seemed that something moved with us. Very light footsteps. And now they were nearer, and then they circled away and back. We stood up and peered into the gloom. A small mottled black and white form was advancing toward us. And presently the eyes of a blue fox came to life. A question in the darkness. A brief exchange of glances. Although we stood quite still, with a frightened shudder our companion was off; a few bounds on the sonorous gravel, and a leap to the cushioned heath and he was gone. This is his island. He came to it across the ice bridges in the winter. He waited here for terns and jaegers and ducks in the spring. He went the rounds of their nests and fought off their piercing cries.

It is too dark to work now, and we walk back to the tent. We tread rather softly. Maybe we hope to see the blue fox again, to be convinced that he is real and not only a Sign. Are we not ghosts ourselves? What are we doing here, breaking stones and uprooting grass on a dark deserted island in the Arctic?

Maury was asleep in the still-stranded plane. Pat was rolled up in his sleeping-bag in the tent. We wriggled into ours beside him and slept for what seemed to be about ten minutes. Soon there came a bellow from Maury through the sound of lashing waves. The tide is in, the Norseman noisily heaving and our gravel crest about to be submerged from both sides. Already the salt water under our air-mattresses is setting us afloat. Having had the imprudence to undress, I have a chilly moment of getting out of my sleeping-bag, of carrying it three-hundred feet to a higher ridge, rushing back for my equipment, helping to tear down the tent. We have hardly done it before our campsite is well under water. Pat splashes about happily through the tidewater in his bare feet. Maury shouts encouragement of a rather profane sort from the cockpit of the plane. Dick—for once!—is not in a very lively mood, and as soon as we put up the tent again on a dry site, he crawls back to sleep.

It is only four o'clock but full daylight again. Fog is still with us and we cannot take off yet. It seems that breakfast is in order. So Pat and I prepare a substantial amount of porridge and bacon. Pat takes his boots off again and carries food to Maury, wading through the icy water to the plane. Dick gets his in bed: incongruous luxury on a desert arctic island.

And now we can get a little more work done as we shall have to wait for the fog to lift. So I set about collecting and sampling the vegetation. In such an adverse environment, the pattern of vegetation is rather clear-cut. I make a generalized sketch which accounts for all of the habitats represented here.

The backbone of the island consists of coarse, angular, limestone gravel ridges. Their highest level above high tide seems to be about twenty-five feet. There is evidence of some slumping, as we found a stone igloo which must have been built on a level area and now has partly caved in on the edge of a slope. This particular point seemed to be the highest in sight. The coarse overdrained gravel has only patches of vegetation, actually large sprawling reddish rosettes of a hard, spiny-leaved saxifrage and a scattering of lesser

(Continued on Page 66)

Industry Cooperates with Secondary Education

● By George A. Rietz, B.S. in E.E., *(South Dakota State College)*
MANAGER, EDUCATIONAL SERVICES, GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK

Science and mathematics play an increasingly vital part in the preparation of pupils for many useful modern vocations. Much depends upon the special interest and the pedagogic skill of the high school teacher.

For some time it has been recognized that instruction in secondary school science and mathematics needs revitalizing.

Here is an account of a smoothly functioning program designed for such a purpose, and conducted by a great industrial concern without cost to selected teachers. The colleges and the General Electric Company feel that it has fully proved its effectiveness.

●

An outstanding and unique educational experiment conducted by industry and certain colleges for secondary school teachers is the summer science and mathematics fellowship programs sponsored by the General Electric Company at four colleges and universities.

Each summer since 1945 General Electric has supported a six-week college summer educational program to help up-grade science teachers. In 1952, the program was expanded to include mathematics teachers, and this year 200 science and mathematics teachers will get six weeks, all-expense-paid, college summer fellowships.

Just a glance at the results of this program in spurring interest in education: 110 members of the present freshman class of Case Institute of Technology are there because of the guidance they received from high school teachers who have participated in the G-E fellowship program. Case granted fellowships to 39 of the 110.

What better argument could there be for industry taking a positive interest in the education of young men and young women?

General Electric and Union College in Schenectady, N. Y., arranged for the first of the summer programs in 1945 for 50 high school chemistry and physics teachers. Two years later the program was expanded and Case Institute undertook to present a program for 50 physics teachers, the entire expense being paid by General Electric.

A year ago the program again was expanded, and 50 fellowships were granted to secondary school mathematics teachers to study for six weeks at Rensselaer Polytechnic Institute, Troy, N. Y. The fourth program will go into operation this year when 50 more mathematics teachers will study at Purdue University, Lafayette, Ind.

General Electric knows the need to revitalize science and mathematics in high schools. The Company takes the broad view that science and mathematics are increasingly important in many businesses. Both serve as good foundations for diverse occupations, and students without one or both find the doors to many jobs closed against them. Even students who do not go on to college or to other institutions of higher learning find that science and mathematics can aid them in getting better jobs after graduation.

The selection of fellows is made by the faculties of the cooperating colleges on the basis of applications and recommendations. All expenses are paid by General Electric, tuition and fees, round-trip transportation, housing, and meals. The colleges provide the faculties and conduct the courses. General Electric sends scientists and engineers to address the classes and arranges trips to its plants and laboratories to show how science and mathematics are used by industry.

The colleges open their recreational facilities to the teachers, and General Electric augments the social activities with dinners and outings. The friendships established by the teachers among themselves and with members of the college faculties and executives of General Electric have proven of lasting value.

In instituting the program, General Electric recognized that secondary school teachers are in a unique position to help young people prepare for successful careers. The large number of young men and women who have attributed their choice of college courses to counseling by G-E science fellows has already justified the program.

College courses serve to bring the teachers up-to-the-minute in their fields, and the General Electric tours give them convincing experience of how indispensable mathematics and science are to present-day business. Many teachers have written back to the colleges and to General Electric that the tours have enabled them to give their students a realistic picture of how the day's classroom problem or experiment might be of future use to the student.

The colleges, too, have expressed their pleasure in the results achieved by the program. Professor Leonard O. Olsen of the Case faculty had this to say in *School Science and Mathematics:*

"Through the establishment and continuing support of this fellowship program the General Electric Company has displayed that it is willing to devote time and money on positive action to improve American science and scientists. It seeks and expects no direct or immediate benefit from this program. The General Electric Company is so imbued with this philosophy that they are unwilling to employ any of the science fellows and thus remove them from their all important role of teaching the young scientists.

"We at Case feel this program is an outstanding success. While we at first hesitated to sacrifice time from research to engage in it, we now feel that there is no other activity which is more fruit-

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Living *with* the Land

• By **Harry A. Kerr, M.S.,** *(Cornell University)*
SOIL CONSERVATIONIST, STATE COLLEGE OF AGRICULTURE, CORNELL UNIVERSITY, ITHACA, N. Y.

Farming is not a simple occupation.

This article should give you a clearer understanding of some of the problems that confront the modern agriculturist and the methods that may be used to solve them.

Here is a discussion of soil types, and how tillage and management methods must be adjusted to them if the farmer is to succeed.

Teachers may help in disseminating this useful information.

●

Man must live in harmony with nature in order to survive on this earth of ours. When the balance is upset, either some species of plant or animal suffers or is entirely exterminated, and man continues on his way toward more civilization. There is, however, one phase of this balance with nature that man cannot afford to ignore. It is the soil resources of the earth that he must learn to live with and maintain, or see himself go down to destruction because of his neglectful stewardship. He must keep the soil particles—whatever size they may be—in place, and he must continue to keep a vigorously healthy, constant, microorganism population within that soil while he grows the food crops for his own and his livestock's needs.

To understand some of the complex problems facing the farmer today in producing the many necessary crops, we must first realize the variety of soils and conditions on which he must carry on his farming operations.

Soils are products formed by weathering of the rocks and the action of myriads of bacteria that live in the accumulating rock particles and organic matter. As time passes vegetation covering the young soil, through the action of its roots, its by-products, and finally, the decaying plants themselves, further modify the original rock material and build up more organic matter and plant and animal food in the upper layers. Changes in temperature and moisture have their effects on the mixture too. As a result we have developed a relatively thin mantle of organic-inorganic, living, dead, and never living mass which we have come to call topsoil.

In addition to weathering and to the bio-chemical reactions that go on in soil-forming processes, other gigantic forces also play a part. Glacial action over much of northern United States has had its effect on the existing soils. Not only does the physical movement of the ice itself tend to distribute a variety of rock material over wide areas, but also the resulting water flows from the melting ice fields of past continental glaciers have further distributed, mixed, and assorted much of this original rock material.

The movement of finer particles over long distances by wind and water ever since the time of the glaciers has in many areas caused large deposits of deep silt and silt loams.

These many forces, both biological and physical, working on and within the earth's diverse crust, have developed over the years thousands of soil types and conditions within the United States.

Soils in any area may be limited to a few, or consist of several of these types depending upon the underlying rock and the conditions which have influenced their development. On a farm in the Northeast may be found only one or two soil types, but in the upland

STRIP CROPPING. A new pattern of agriculture. Level fields on sloping land by following the contour. Alternate sod and grain or row crops help to control water movement over the surface of the land.

AN EXAMPLE of severe gullying in a hillside potato field on upland soils in New York State due to poor soil and water management practices.

areas, farms can have as many as eight or ten different land and soil conditions.

It is in adapting his tillage and management methods to the soils and topography of his farm that many a farmer has made an unwise choice. These farming methods, many of them brought here from home lands with different climates and soils, have resulted in severe erosion of the soil particles, and water losses on land that with the right methods can be farmed permanently.

To better fit the farming system and crops to the land one must first know the soil conditions on which the crops are to be produced. The Federal Government, in cooperation with the States, has in the past few decades developed methods of classifying and mapping soils and land conditions, and has mapped much of the country in varying degrees of detail. These soil maps, and the more recently developed Conservation survey maps, are available from County Agricultural Agents or Soil Conservation District Offices.

From these Conservation survey maps, which show cover, slope and erosion as well as soil type, has been developed a land classification system denoting the productive capabilities of land. Land Capability Class I is that land which is flat or gently sloping and has a well-drained soil, easily tilled during the growing season and not subject to erosion damage. This land will be in agriculture permanently under the usual good farm management practices of fertility maintenance. Land Capability Class II generally has one factor that somewhat limits the use of the land for intensive cropping. It may be a moderately sloping area where surface runoff water could accumulate and cause severe sheet or gully erosion, or it may be Class II land because of slow internal drainage of the soil, or a combination of these and other limiting factors.

Land Capability Class III is the steeper slopes and heavier soils which will suffer severe erosion and surface water loss when cultivated too intensively or in large blocks, without due regard to length and steepness of slopes.

These first three land capability classes are those on which it is recommended that the cultivated crops be produced. Land Capability Class IV, due to its steepness of slope, slow internal drainage or high erodibility should be kept in grass and legume sod crops for hay or pasture, or some less intensive use such as forests or wildlife areas. Land Capability Classes V, VI, VII, and VIII have additional limiting factors and are generally limited to forest land, wildlife areas, or watershed protection areas. For those interested in a complete discussion of Capability Classes, leaflet Number 249 from the U. S. Department of Agriculture is recommended.

Once the physical characteristics of the soil conditions as shown on these soil and conservation survey maps are known and understood, fitting the crop and the necessary soil and water management practice to the land becomes a much easier task. It is in this area that teachers working with students from all walks of life can be of most valuable service to mankind.

By this, one would not infer that we all should know as much about soils and their use as the surveyor, the conservationist or the farmer. What should be well known, however, is that to produce enough food and fiber for our growing population these thousands of soil and land conditions must be utilized. Further, to have a permanent agriculture, existing conditions must be known and the crop planted which will produce bountifully under the given circumstances of soil and climate. We must be aware that some changes are necessary in our farming methods (held over from the past) to achieve a safe, profitable, permanent agriculture on much of our land.

For example, on the well drained, deep gravel, sand and silt soils of the valley bottoms, the problem is generally one of keeping a high fertility level through the use of chemical fertilizers, and of maintaining organic matter within the soil by liberal use of farm manures, winter cover crops, and a rotation of crops containing one year or more of grass and legume sod.

As a large proportion of our agricultural land is rolling to hilly, much of it is subject to erosion to a

SOIL PROFILE. The spread of the man's hand indicates the relatively shallow "topsoil" that has developed on this well-drained, water deposited gravel soil material.

A WELL LOCATED POND, such as this one, adds much to the joys of living as well as being useful in the farming operations. Farm is in Dutchess County, New York.

greater or less degree. The key to the control of erosion on such areas is the proper management of water.

A raindrop falls at a velocity of about 20 miles per hour. Two inches of rain on an acre then would have 6,000,000 foot-pounds of kinetic energy. This is enough energy to raise a seven-inch layer of soil three feet into the air, over an area of one acre at one time.

Now we all know that two inches of rain does not come in an instant, but intensities of two inches in 20 minutes occur all too frequently. At such times the total energy expended by the falling rain must be absorbed by the soil itself or the cover thereon. When viewed from this angle the value of cover on the land by dense healthy crops is readily appreciated.

Since much of our farming is a compromise between keeping the needed cover on the land at all times and the need for growing food and feed crops, methods have been devised whereby it can be done with a minimum of soil erosion. Instead of large rectangular fields laid out on the hillsides according to Euclidean ideas and adapted to land surveying, now longer, narrower fields that conform to the contour of the land are proving to be an added help in good land and soil management. By alternating fields of dense sod crops with cultivated row or grain crops, water which runs off the cultivated field or strip is spread out and retarded by the sod.

On long slopes where runoff water concentrates in draws and waterways, and strip cropping on the contour is unable to control the running tide, diversion terraces are used to safely "walk" the water across the slope to a prepared or natural outlet. What is a diversion terrace? Nothing more or less than a grassed eaves trough or channel constructed at right angles to the slope which functions much the same as the eaves trough on your house. It intercepts runoff water and channels it at a safe speed to a desirable outlet where is it disposed of at little inconvenience.

Needless to say, to do the job properly, engineering skill is needed. This can be obtained through your County Agricultural Agent or Soil Conservation District. Also it follows, that with volumes of earth material to be moved in constructing terraces, heavy machinery should be used. Again, the Soil Conservation Districts are set up to provide, at cost, the services of heavy machines to do the conservation job.

Further erosion controlling measures such as sod waterways, tile drains, and other water management measures are needed to fit various field conditions. Improved plant varieties adapted to wider ranges of environment, better fertilizers and more careful land management all enter into the conservation picture. The problems of land and water management can no doubt be answered with information currently at hand when considered in the proper order and sequence.

One of the water management and use features that needs no selling is the idea of a pond on every farm. Not only is the domestic water supply and fire protection value of a well located farm pond easily recognized, but the scenic and recreational value of a small body of water is appreciated by everyone, young and old alike. How better can an acre of land be used than to provide the farm family with summer and winter recreation, the livestock with a guaranteed water supply, and the farm buildings with fire protection? A farm pond is the answer; it can be provided on many, many farms at relatively little cost.

When dealing with volumes of earth fill and water as we do when we build and maintain a pond, engineering design and careful construction are of prime importance. Many states now require approval and certification of plans before any sizeable pond can be built. Such a procedure is for the owner's as well as downstream farmers' protection. One should be sure to comply with such regulations where they exist.

How may we as teachers help to bring about a better understanding of the needs for many of these measures to insure our food supply? First, by understanding a little better that the soil is alive. To keep it productive it must be kept alive and living where it can be used for crop producion.

Next, we can observe the land conditions around our school and village to learn what is being done and what

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LOOKING DOWN the channel of a completed diversion terrace before a seeding is established. The owner of farm stands on the berm or dike at left with his interested neighbor standing in the bottom of the channel.

Conservation of Vision

● By Jane Anderson

ASSISTANT IN VISION CONSERVATION, BUREAU OF HEALTH SERVICE, DIVISION OF PUPIL PERSONNEL SERVICES, NEW YORK STATE EDUCATION DEPARTMENT, ALBANY, NEW YORK

One-fourth of the children of school age have visual defects that need correction. The situation is serious enough to warrant our attention.

Schools must accept this responsibility to help children and their parents to become aware of the need for careful protection of sight.

Here is a brief and clear statement concerning eye sight, and what can be done to remedy its most common defects.

●

The New York State Education Department has, for many years, been concerned with the health needs of all school children. Not the least among these needs is conservation of vision.

The medical inspection law passed by the Legislature of this state in 1913 requires an annual test for visual acuity and the notification to parents of the need for correction of the defects found. The school health service program encompasses more than the mere discovery and correction of defects. Its most important function is to provide broad educative and preventative measures for all pupils.

Let us consider the eye and how it functions so that we will have a better idea of how vision can be conserved.

Human sight is a highly complicated process. It is dependent upon light and the brain as well as the eye. When we see, rays of light are reflected from an object to the eye; they are then refracted or bent within the eye to form a point of focus on the retina or nerve coat of the eye. The image formed by the rays of light is then sent through nerve fibers to the brain where it is interpreted.

The eye itself is an optical device much like a camera, the important difference between the two being that the eye is composed of living tissue. While the eye is a part of the nervous system, it is affected by the other parts of the body, particularly by the glandular and circulatory systems.

It has been said that, just as the eye depends upon the health of the rest of the body for its well being, so is the eye a barometer for the health of the rest of the body. Systemic diseases such as diabetes and nephritis, and infections such as diseased teeth or tonsils, do affect the general physical state. It is well to keep in mind that these diseases and infections, if not kept under control, may eventually affect the eye and vision. The eye specialist can detect the effects of such diseases by looking into the eye with a lighted instrument called an ophthalmoscope. Children, in particular, frequently have mild eye infections, the most common being conjunctivitis or "pink eye" and crusted lids. These infections are often a sign that something is wrong; perhaps the child is not eating properly or his habits of hygiene need improving.

The normal eye is about seven-eighths of an inch in depth and has an even curvature in all meridians. It will focus parallel rays of light which come to it from a distance of 20 feet or more. When we view an object closer than 20 feet, the rays of light are diverging, and it is necessary for the eye to increase its refractive power in order to focus the image clearly. This change in refractive power, which is called accommodation, is accomplished by an increase in the size, and hence the curvature, of the lens.

Many people have refractive errors, that is, eyes that are irregular in size or shape. The far sighted or hyperopic eye is shorter from front to back than the normal eye. To obtain a clear image, some degree of accommodation is needed for distance and an even greater than normal amount of accommodation is required for near vision. Often times people who are hyperopic will have symptoms of eye fatigue after long periods of close work. Small children are usually hyperopic, but as a general rule they are not required to concentrate on objects close to them for very long periods of time. Glasses will correct this condition, but the need for glasses is determined by the individual's tolerance of the hyperopia and the extent to which he uses his eyes for close work.

The nearsighted or myopic eye is one that is longer than normal. In this condition the parallel rays of light (from a distance of 20 feet or beyond) reach a focus in front of the retina, hence the myope does not see distant objects clearly. The only way he can overcome his difficulty without the help of glasses is to bring objects so close that the rays of light will be sufficiently divergent to be focussed on the retina. This may result in lack of exercise and poor posture. Properly fitted glasses will give the myope sharp vision for both distance and near.

A person who has astigmatism sees objects that are blurred or distorted because of an irregularity in the curvature of the eye. Astigmatism, probably the most troublesome of the refractive errors, can usually be corrected satisfactorily by glasses.

Children are sometimes cross-eyed and many adults have the idea that they will outgrow this condition. The eyes must work like a team of well trained horses. If they do not, the crossed eye cannot work with its mate. This may result in loss of vision in the turning eye and eventually loss of the ability to judge distances. Any young child whose eyes turn in or out should be placed under the care of a competent eye specialist as early as possible. Correction for this

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Chocolate -- 1492 to 1953

• **By Arthur S. Graham, B.S.,** *(University of New Hampshire)*
RESEARCH CHEMIST, HERSHEY CHOCOLATE CORPORATION, HERSHEY, PENNSYLVANIA

Linnaeus named it "the food of the gods." Modern man has found no reason to challenge the nomenclature.

The ever-increasing popularity of chocolate as a food and as a confection during three centuries or more testifies to its great value as a food and to its delightful flavor as a confection.

Read this fact-filled article to learn something of the biology and chemistry and engineering involved in the treatment of the cacao bean, and in the manufacture of sweet chocolate, baking chocolate, cocoa butter, cocoa and the popular milk chocolate bar.

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History

It was 360 years ago that Christopher Columbus discovered America—the great feat which we Americans duly celebrate each October 12. It was also 360 years ago that the white man first saw Chocolate, the first white man who did so being that same intrepid explorer.

This has been told us by historians who say that Columbus returned to the Royal Court of Spain with a few cacao beans as curios of the newly discovered land. It is probable that the Genoese knew nothing of the flavor or the food value of these strange seeds which the natives were using as a medium of exchange. One writer has noted that 200 cacao beans was the purchase price of a good slave.

The cacao bean played an important role in the traditions and legends of the Aztecs of Central America. Perhaps no other food has so romantic a history. The exotic tropical tree which produces this seed is believed to have been cultivated since ancient times. The Central American Indians considered cacao to be of divine origin, having been brought from Paradise and sown in the gardens of Quatzalcault, the great prophet of Aztec mythology. By eating the fruit, he acquired universal knowledge and wisdom and was held in great reverence by his people.

The commercial history of the cacao plant and its fruit began in 1528 when Cortez conquered Mexico, which was then ruled by the Emperor Montezuma. At the height of Aztec power, one of the customs at the Royal Court was to celebrate important events with great feasts. Montezuma consumed huge quantities of chocolate beverage served to him in golden goblets which, upon draining, he threw into the lake. After his victory, Cortez drained this lake and found enough gold to make his labors well worth while. Cortez sent a supply of cacao beans, together with instructions for producing a beverage, to his Royal Master, Charles V of Spain.

The original cacao products were not sweetened, and much impetus was given to their use when Spanish nuns of Guanaca developed formulas for sweetening them. Spain, the first country in Europe to manufacture chocolate, was a leader in the industry for many years.

The use of cacao spread to Italy, Austria, and France, but because of its scarcity and high cost only those of royal blood were able to enjoy its delectable flavor. It reached London about 1700, and the English immediately considered it to be high fashion to partake of the beverage under proper social surroundings. This led to the opening of Chocolate Houses which, in reality, were restaurants where the wealthy gathered to taste this new delight. So, after 200 years, chocolate became known to people other than Indians and royalty.

Biology

Cacao beans, so-called, are actually the seeds of trees belonging to the species, *theobroma cacao*. These trees flourish in a warm, moist climate within an area of about 20° North and South of the Equator. The cultivated tree grows to a height of about 25 feet, and produces leaves, flowers, and fruit throughout every month of the year. The flowers of the tree are very small and, in a manner similar to many tropical trees, are carried on the main stem of the branches and on the trunk, singly and in clusters. The fruit, when ripe, is a rich golden-red pod resembling a cucumber. Within an outer shell of about one-half inch thickness is contained a sweetish pulp, enclosing 20 to 40 almond-shaped seeds which, when fermented and dried, represent the cacao beans of commerce.

At harvest time, the natives cut the pods from the trees with knives attached to long poles. The pods are gathered in heaps and the natives, often women, cut them open and scoop out the contents into baskets. The beans are then piled, covered with banana leaves, and allowed to ferment for several days. When fermentation is complete, the beans are dried and bagged for shipment.

The word "cacao" has long since been anglicized to "cocoa," and today throughout all trade channels in the English speaking world cacao is no longer used. Although cocoa beans are indigenous to our own Central America, today they are grown and harvested throughout many sections of the tropics. More than one-half of the world's cocoa crop is produced in British West Africa, particularly in the Gold Coast and Nigeria from which regions are received the Accra and Lagos beans respectively. Brazil produces the Bahia beans, next largest in quantity and then come the Sanchez beans from the Dominican Republic. Other important crops, particularly in the high flavor class, are the Arriba beans from Equador, the Caracas beans from Venezuela, and those from Trinidad, Ceylon,

Samoa, and Java. Each of these beans has its own characteristic flavor; some are quite different from the others in color.

Manufacture

The chocolate manufacturer, as he receives these various types of beans, uses his skill in blending them in such a manner as to yield the exact characteristics of flavor and color he desires. His first operations are those of cleaning, roasting, hulling or winnowing, blending, and grinding. Roasting is the most important of these processes, for it is largely responsible for the flavor of the finished product in whatever form it may take.

The removal of the shell is accompanied by the breaking of the beans into fragments called "nibs." These nibs are quite dry and conceal the fact that they have locked in their cell structure an average of more than fifty-four per cent cocoa butter.

In the milling process, the nibs are finely ground and the butter is released from the cells, the effect being the production of a free-flowing liquor of rich dark color and heavy aroma. In this form, it is known to the manufacturer as "chocolate liquor," and is the basic material from which he produces other chocolate products. Some of it is cooled and solidified into cakes which are sold to the housewife as "baking chocolate."

To manufacture cocoa and cocoa butter, the heated chocolate liquor is placed in huge hydraulic presses where it is subjected to a pressure of 6000 pounds per square inch. This pressure forces some of the cocoa butter through a retaining medium which holds back the solid mass.

The cocoa butter is filtered and used by the manufacturer in several ways. He uses it in making "sweet chocolate" and "milk chocolate," or cools it and solidifies it into various forms and sells it for confectionery, pharmaceutical, and sundry other uses. Cocoa butter has certain unique properties. It is one of the most stable edible fats, it possesses a pleasant flavor and aroma, and it combines well with other confectionery ingredients. Furthermore, it is solid and is easy to handle at ordinary room temperature, yet it liquefies at body temperature.

The mass that is left in the hydraulic press after the cocoa butter has been removed is in the form of large hard cakes. It is reduced to its final usable form by pulverizing it into an extremely fine powder. It is then packed in containers and sold to the housewife as "breakfast cocoa," and also to confectioners, bakers, ice cream manufacturers, and others.

Probably the most popular chocolate product is the milk chocolate bar. Chocolate liquor, pure fluid whole milk, and granulated sugar are its basic raw materials. After dehydrating the milk, and intimately mixing these substances the sweet milk chocolate mass is passed through a series of large steel-roll refiners where an intense shearing and rubbing action produces a uniform paste, which is so smooth that no individual particles are apparent to the taste. This smoothness is one of the characteristics which make chocolate a delight to the palate—but this is not enough. To further improve the product, it is processed for several days in machines called "conches," in which the chocolate is pushed back and forth by a large cylindrical stone rolling on a stone bed. By this action, any rough edges on the fine chocolate particles are smoothed off, desirable flavor is further developed, and the entire mass is most intimately blended together. It is in the conches that the last delicate flavor effects, which we have come to expect in fine chocolate, are developed.

After conching, the viscosity of the chocolate is adjusted to the point where it is most easily handled, and it is then cooled and cast into bars, blocks, and other forms. Almonds, peanuts, or other ingredients can be added before casting, if desired.

"Sweet chocolate" and "semi-sweet chocolate" are processed similarly to milk chocolate except that no milk is used. A good deal of these are sold to confectioners for making chocolate-covered candies. Increasingly large amounts of semi-sweet chocolate are being used by the housewife to make cookies, candy, cakes, and other items.

Chemistry

The cocoa and chocolate industry is a food processing industry. In the manufacturing operations commonly used, chemical changes are largely incidental to physical changes. However, those which do take place produce certain flavor and color effects which have a profound bearing upon the acceptability of the finished product. The food chemist plays an important part in the control of processing and in the maintenance and improvement of the quality of finished products. It is the subtle difference between one manufacturer's product and that of his competitor which enables one to find consumer acceptance and to achieve great popularity, while another may meet with indifferent response.

Chemical changes begin the moment the cacao pod is opened and the beans are removed. The beans, imbedded in a white or pinkish fruity pulp, are heaped together in piles, or in vats or boxes, and covered. Fermentation takes place and the pulp is gradually changed to a vinegary liquid which is drained off.

The temperature of the beans gradually rises sufficiently high enough to kill the germ. The cell walls then become permeable, and the biochemically active ingredients within, mix and react.

Pronounced flavor and color changes take place. In the case of beans with a bluish-violet color, the color is changed to reddish-violet by the action of the acetic acid. Under the influence of the oxidase present, the reddish-violet color is converted into a brownish color. This is due to the oxidation of some of the tannins present and is accompanied by a loss in the astringency of the beans.

After fermentation, the beans still contain about 33 per cent of water and this must be reduced, desirably to 6 to 8 per cent by drying, to obtain a product which can be stored. During the drying process, air continues to penetrate into the bean and enzymatic oxidation is completed, resulting in a further reduction

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Writing on the Sand

● **By Reverend E. Hamelberg, C.S.Sp.**
MISSIONARY, MISSION OF THE HOLY GHOST FATHERS, ANGOLA, WEST AFRICA

We are confident that this most unusual story will interest all our readers. We believe, too, that it will have special significance for both amateur and professional anthropologists.

The stories written on the sand by the Chokwés of Portuguese West Africa, and the manner of their production, may stem from very ancient peoples.

THE SCIENCE COUNSELOR *directs attention to this curious primitive art in the hope that interest in it will be stimulated, and the writings receive the detailed study they merit.*

●

In the northeastern part of Angola or Portuguese West Africa, in the region usually called Lunda, live a relatively primitive people known as *Chokwé*. The plural form is Tu Chokwé, and the singular Ka Chokwé.

What is singular about the Chokwé is not their name and its variants, but the fact they possess a symbolic language that is literally *written in the sand*.

So singular and refined are the designs which these so-called "savages" imprint on that shifting material, that one person to whom I showed a few of my reproductions said with a somewhat superior air: "That sort of thing was not invented by your Chokwé natives . . . One of your missionaries must have taught them how to do it."

The fact is that the inhabitants of the little village in which I collected the greater part of my designs, had never laid eyes on a missionary and it is absolutely certain that the "ancients" of the place who explained the symbols to me, had never before seen any missionary either there or anywhere else. Again, it is evident that the meanings they attached to the drawings are derived from a folklore that is one hundred per cent African.

The same critic, meeting me at a later date, told me: "I have given a great deal of thought to the drawings you showed me . . . What I now think is that the Chokwés must have learned their art from the . . . Chaldeans!"

I realized that this observation came from a good man and that he was in earnest, so I checked my desire to laugh at so far-fetched an explanation. And yet, later on, reflecting on that remark about the Chaldeans, I started dreaming dreams about the origins of the Chokwé and their singular practices.

One thing is certain: Africa has not yet revealed all its secrets. It continues to mystify us at many a turn.

It is quite possible that these drawings have origins that are very remote in time and place, but whatever their origin, I feel confident that they will be of interest to my readers. In any case, a little publicity and the recognition of the artistic talents of my Chokwés will not do them any harm.

I had the good fortune of staying in their midst for a period of two years and that gave me the opportunity of making copies of a number of drawings which I saw them make from time to time. My only regret is that I had to leave Saurimo before I was able to complete my collection and so better satisfy the scientists and artists who might be interested in such things.

I made the acquaintance of a native called Camuimba who in my estimation was one of the best "sand artists." Having observed him during his performances I invited him to come to the nearest Mission of the Holy Ghost Fathers and give me another demonstration. He burst out laughing and said, "Do you really mean that I ought to go to the Mission for such a trifling matter?"

It is a fact that his people consider the execution of such drawings as nothing more than a kind of game. To me the very ease with which some played that "game" made me realize that these so-called primitive people possess a high degree of culture and art. But there was something even more interesting than the execution and outward appearance of the designs; namely, the thought or the story symbolized by each drawing.

A CHOKWE' of Angola, West Africa. This tribe practices the art of writing on the sand.

First of all let me explain the method of writing on the sand. The designs are made by hand. They are traced on the sand by the index finger. There is never any want of canvas or paper for this sort of drawing, for all that is needed is sand, and the soil of Lunda is predominantly sandy. Here is the way the artist proceeds:

In order to preserve an equal distance between the various points and lines of the drawings—a thing that is most important for unity and harmony—the artist bends the fingers, joins the thumb and the little finger, as is done in the Scout salute. He then raises and straightens out the middle finger and marks the dots on the sand with the tips of the stiffly held index and fourth finger. In this way he marks the first two dots. In order to trace the other dots on the same line and keep the same intervals between them, for example, moving towards the right, he next places the tip of the index in the mark left by the fourth finger, and thus marks a third dot; and so on. The secret of the perfect symmetry of the figures lies in the precise marking of numerous dots that radiate from the first markings.

When the artist has marked the desired number of dots, according to his preconceived plan, he traces the lines, using his index finger.

"Professionals" make such drawings with incredible speed and almost casually so that when I first witnessed this "sport" I could not help expressing my astonishment. They laughed in turn at my naiveté.

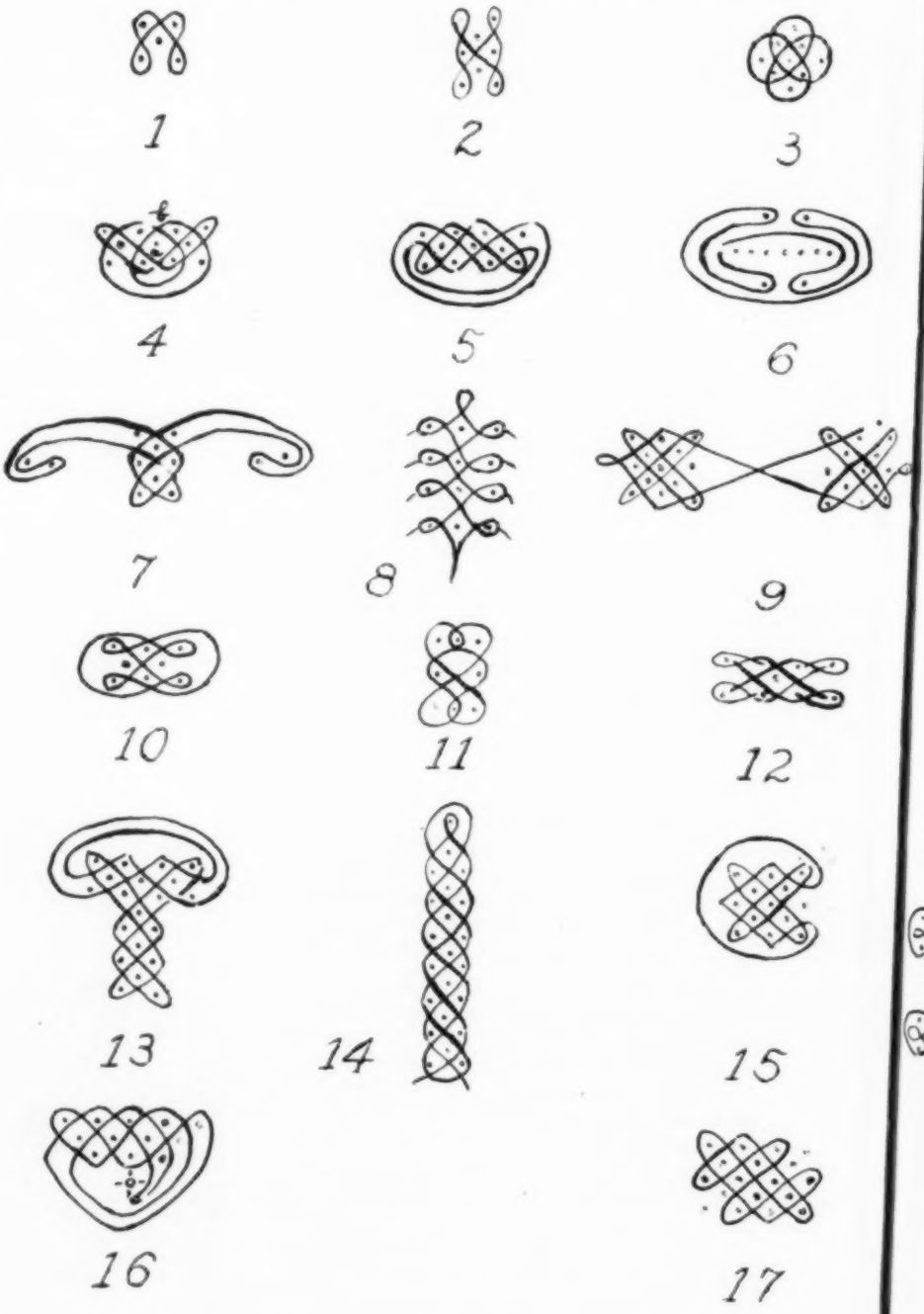
Using graph paper that was ruled in squares I was able to make accurate copies of the drawings before the heartless wind or some other cause could wipe them out. I found out later that my copies and imitations of the Chokwé art gave me an excellent introduction to the Chokwé villages. It broke the ice with them, so to speak.

When I asked them the name of the drawings, they answered simply: *Sona*. But that is a term which signifies writing in general.

I have tried to express the meaning of the various designs in the way they were given to me by the natives. There are a few which I failed to understand properly. I am hoping that someone, myself perhaps, will have the opportunity at a later date of completing the investigation of this fascinating primitive art.

In the list of commentaries which follows, the numbers refer to the individual drawings reproduced herewith.

1. A bird in its nest. The bird is represented by the central dot; the nest, by the four other dots that are surrounded by lines.
2. Two birds in their nests.
3. A nest of field rats.
4. The dot on the lower left represents a man called Sa Chituku; the dot at the lower right is his wife, Na Chituku, who gave little evidence of having seriousness in her makeup. When her husband Sa Chituku was away from home, Na Chituku, instead of taking care of her cooking and the home, wasted her time in gossip with the men and women of the neighborhood. In order to put a stop to such



unbearable conduct, which was doing considerable harm to the family, Sa Chituku made a large enclosure (the line a), and then a second one (the line b) to be doubly sure. In this way when Lady Na Chituku had the urge to leave the hut, she was unable to execute her project without meeting her husband. Others say: "Sa Chituku alone thus had access to his flighty and fickle consort."

5. Same meaning as drawing No. 4, but the enclosures have been duly reinforced.
6. A camp of Circumcision (Mukanda). The central horizontal line of dots represents the children (Tundanji) who are being prepared for the ceremony: they are unable to leave the camp. The two dots at the top represent the guardians who watch over the camp; those at the bottom are the guardians who supervise the children.
7. A deer.
8. A porcupine.
9. Two dogs; more exactly a male and a female dog.
10. The foot of an antelope (?).
11. A species of egg-plant (aubergine).
12. A very complicated story about a child-prodigy called Ndala Kayitanga, who always manages to escape when someone attempts to kill him. The child is represented by the central dot in the drawing.
13. A Mukiji, a man wearing a mask which enlarges his head.
14. A large snake.

15 and 17. A story about Circumcision which I failed to understand properly.

16. Once upon a time the cock and the cuckoo were quarelling. Each bird maintained that it was he who caused the sun to rise by means of its morning song. Finally the other birds were called in as judges. They decreed, "It is very simple indeed: Tomorrow morning you will both sing and we shall see which one makes the sun get up." The cuckoo, who has the unfortunate habit of always pushing himself forward, decided to start first and began to sing long before dawn. But he soon got tired and became silent. No sun appeared as a result of his efforts. Some time later the cock began to sing and soon the sun appeared at the horizon.

    It is easy to recognize the sun represented in the drawing; the cuckoo and the cock are represented by the first two dots on the right.

18. A Muyombo, a species of tree that has extensive foliage and is planted at the time when a new village is founded. It usually marks the hut of the chief. It is well to note that the Chokwés quite readily change the location of their villages.
19. This is another version of No. 18.
20. A pile of grass with which the people cover their huts. In order to transport it more easily, they fold it over and over again.
21. Wild ducks in full flight. Who will say that the Chokwés have no artistic talent?
22. An animal hidden under a large

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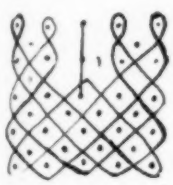

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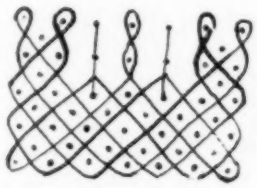

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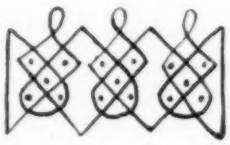

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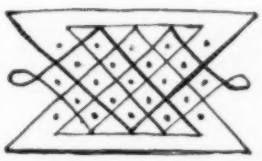

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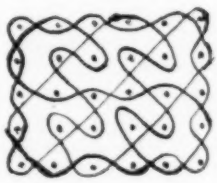

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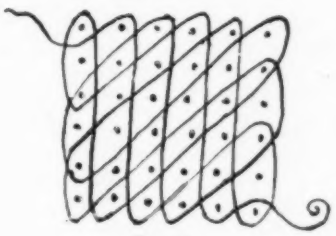

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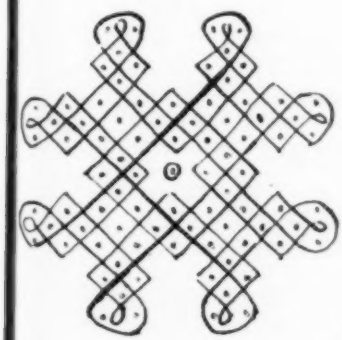

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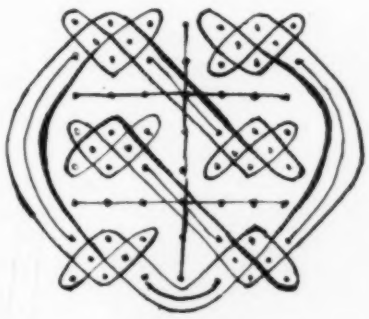

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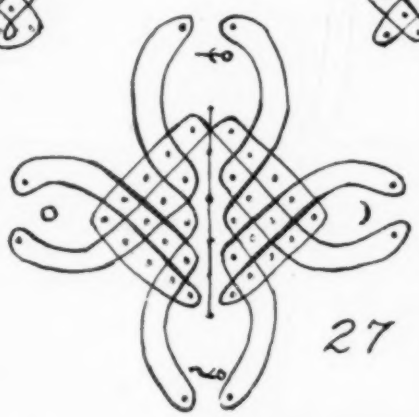

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American Free Enterprise Illustrated in a Basic Industry

● By **M. Edmund Speare, Ph.D.,** *(Johns Hopkins University)*
EDUCATIONAL DIRECTOR, BITUMINOUS COAL INSTITUTE, A DEPARTMENT OF THE NATIONAL COAL ASSOCIATION, WASHINGTON, D. C.

Americans are so accustomed to the benefits enjoyed by industrial workers under our free competitive system that we take them for granted.

But Europeans are quite likely to be amazed at the high standard of living that is enjoyed by our coal miners, for example.

Recently, British, German, Austrian and Japanese coal mining officials and industrial relations experts have visited the United States to study our methods of production. They were impressed by what they saw and learned.

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British, German, Austrian, and Japanese Visit the USA to Study our Scientific Coal Production Methods

Not so long ago *Time* magazine declared that the basic cause of Europe's ills was its inadequate production of coal. "This shortage," said the writer, "underlies Europe's dollar deficiencies, its currency distempers, its lack of pep, and its chronic sweat and tears." On both sides of the Iron Curtain the shortage of coal chilled the poor, rocked governments, distorted economies, and hampered rearmament. In the West it threatened just then to undo much of the good done by the Marshall Plan. And in the East it blocked Communist five-year plans.

A GROUP OF TYPICAL AMERICAN MINERS IN CONFERENCE AT AN UNDERGROUND MINE.

What was the reason? While Europe's industrial output had risen 40 per cent above pre-war, the coal output on which industry depended was down 7 per cent. Even Britain, which used to export 44 million tons a year, was no longer exporting coal because of the exchange difficulty with sterling. And Europe generally had to deplete its dollar reserves for our coal, whose cost had doubled by the long voyage. In America, where the industry is free, competitive, therefore efficient and progressive, our coal, basic ingredient of industrial civilization, is produced with great efficiency and in abundance. Our annual production nears half a million tons of bituminous. Great Britain, with her 300,000 more miners than we have, produced only 249 million tons in 1951. West Germany produced 223 million tons. Japan 49 million tons. Our country was away ahead of all others.

Our modern mechanized coal mines are mass production factories, underground and aboveground, and today's American coal miner is, for the most part, a skilled operator of amazing machinery. About 98 per cent of all our coal is cut mechanically, and over 75 per cent of it is loaded mechanically. The *base* pay scale for the whole American coal industry, under the contract signed September, 1952, is now well over 18 dollars per day on the average. In addition the American miner is the beneficiary of health and welfare plans, a generous annuity system, and he gets paid vacations. The average American miner produces as much coal in a single day as a British miner produces in four days, or as the Japanese miner produces in one whole month! The daily income of the European miner, English or German, or of the Japanese miner, is correspondingly very much smaller.

Discontented with the state of their coal industries, and well aware of the superiority of American production methods and the greater skill of the American miner, British, German, and Japanese coal mining officials and industrial relations experts, have been visiting the United States during the past year to study our mining and production methods. On August 12th, 1952 a group of six German experts conferred with executives of the National Coal Association and the Bituminous Coal Institute, at their Washington, D. C. headquarters with the hope of obtaining help to solve their production problems. They studied the new Institute coal production film "Powering America's Progress," and conferred with National's executive vice president and

(Continued on Page 70)

NEW BOOKS

The Nature of Some of Our Physical Concepts

• *By* P. W. BRIDGMAN. New York: Philosophical Library. 1952. Pp. 64. $2.75.

This book contains three lectures given at City College, University of London in 1950. In these lectures the author has attempted an analysis of the operations involved in some of our physical concepts, particularly an analysis of the operations into their instrumental and their "paper and pencil" and verbal components.

In former writings the author has already stressed the operational point of view, namely that the most important aspect of the meaning of a physical concept lies in the operations to which it leads. It is of interest to note that the author in his new book points out that it is erroneous to suppose that these operations *must* be instrumental operations. Paper-and-pencil operations (e.g. manipulations with symbols used in mathematics) are to be included among the operations which give meaning to a physical concept. It is still more important that the author is aware of the fact that the operational aspect of the meaning of a concept is not the only one. This prevents the one-sidedness from which so many philosophical expositions of scientists suffer.

Nevertheless, philosophical discussions do not form the main content of this book. The main content consists in a detailed analysis of such specific physical concepts as "field" and "energy" and of some of the concepts by which electrical phenomena are described.

In order to follow the author in his careful distinction between the instrumental and the "paper and pencil" components of the physical concepts the reader must be well acquainted with physics. Otherwise much of the content of this book which can be considered an important contribution to the logical analysis of science will be lost.

Andrew G. Van Melsen, D.Sc.
Nijmegen University
The Netherlands

The March Towards Matter

(Descensus Averno)

• *By* JOHN MACPARTLAND. New York: Philosophical Library. 1952. Pp. 80. $2.75.

The somewhat mysterious title of this book aims to express a trend of modern science and philosophy which, according to the author, has gradually resulted in a materialization of the life of the mind since the days of Descartes. The main value of the book consists in the fact that it explains some important aspects of the Thomistic doctrine of human knowledge. As a discussion of the tendencies of modern philosophy the book is too compressed.

A. G. M. v. M.

History of the Theories of Aether and Electricity

• *By* SIR EDMUND WHITTAKER. New York: Philosophical Library. 1951. Pp. XIV + 434.

This volume describes the history of the theories of aether and electricity from the days of Newton till the age of Lorentz. In a second volume the story will be continued till the present time.

The scientific world will be grateful to the author for this study. It is not easy to trace the steps by which the modern theories have been built in the past. The merit of each step in the development of a theory has to be evaluated both by the contribution which it has given to the modern theories and by the value which it possessed in the light of the knowledge available at the time when the step was made.

We regret, therefore, that in the first chapter the author seems to consider that the only value of the philosophical concepts of the scholastic systems is their value for science. It is true that the Aristotelians of former centuries have used these concepts in a scientific context, and in this respect Whittaker's criticism is justified. But he seems to think that those philosophical concepts did not have any value at all, and that is not justifiable.

The above remark does not in the least diminish our admiration for the specific value of Whittaker's work. For this value lies in the field of the history of science proper.

This history of some of the most important physical theories is not written for laymen. Physicists, and especially teachers of physics, will, however, greatly benefit from it.

A. G. M. v. M.

Materials and Processes

• *By* MAX KOHN AND MARTIN J. STARFIELD. New York: The MacMillan Company. 1952. Pp. VIII + 483.

This is a carefully written and generously illustrated textbook for students attending vocational-technical high schools, and for use in apprentice and adult training programs in schools and industry. Salesmen of the industrial materials described in it will find in the book information of value.

The authors appear to have done well what they set out to do . . . "to give the reader information which will help him choose his vocation, and knowledge which will help him find, select, use, and understand the processing of the basic materials of industry. The book is also designed to meet the needs of those readers who becomes sellers, fabricators or consumers of materials or designers of structures or machines."

The book's five sections deal with wood, fuels, ceramics, metals and plastics. An idea of the general manner of treatment may be gained from the section "Wood and Its Products." There are chapters headed: Introduction; Structure of Wood; From Tree to Board; Seasoning Wood; Plywood—An Improved Wood; Paper; Forestry. Both writers are connected with the department of industrial processes of the Brooklyn Technical High School.

H. C. M.

More Modern Wonders and How They Work

• *By* CAPTAIN BURR W. LEYSON. New York: E. P. Dutton and Company. 1952. Pp. 192. $3.50.

Another interesting little book for your school library. In it Captain Leyson continues to do what he has done so well in his score of other books—explain complex devices and ideas in terms simple enough for boys of high school age to understand. Nearly half of the book is devoted to guns and their construction, and to what happens when they are fired. There is an interesting chapter on the development of locks and locking devices. Ultra high frequency (UHF), what it means and what it can do; hydraulic transmissions for automobiles; atomic powered engines; weather instruments; and phonograph recording all are considered in some detail.

H. C. M.

Astronomy for Everyman

• *By* MARTIN DAVIDSON, Editor. New York: E. P. Dutton and Company, Inc. 1953. Pp. XIII + 494. $5.00.

A book well worth considering for the libraries of the secondary school and the college. It is designed for the layman as well as for the specialist. The teacher of general science will find it helpful.

The services of 12 British authorities have been called upon to explain in a readable and not too technical manner what is known about the sun, moon, stars, planets, comets, and other heavenly bodies, and how our knowledge has been acquired. The Editor contributes the Preface and the first chapter, which gives a general view of the universe to orient the reader before he begins to study the specialized sections that follow. There are chapters on the aurora and zodiacal light, on light and instruments, on navigation, and on the history of astronomy. There are many line drawings and photographs. The concluding chapter discusses interplanetary flight, rocket propulsion and the possibilities of manned space flight. Today's fuels are cumbersome and expensive. The answer may be in harnessing atomic energy for propulsion.

H. C. M.

The Junior Book of Insects

• *By* EDWIN WAY TEALE. New York: E. P. Dutton and Company, Inc. 1953. Pp. 249. $3.75.

An entertaining introduction to entomology that deserves a place in every school and public library. Dr. Teale is so well known through his other books and his many journal articles that it is only necessary to state that this book is written with his characteristic selectivity, clarity and enthusiasm. It was published originally in 1939 as *The Boys' Book of Insects*. The new and revised edition, which follows six printings of the original text, brings the material up to date and adds a new chapter on recording the life histories of insects. From this book the junior scientist may learn how to collect, rear, and study common insects such as flies, wasps, beetles, ants, and water insects. He will learn many facts about their lives and habits, and how to make and store insect collections. There are special chapters on Collecting with a Camera, Hunting With a Flashlight, Keeping an Insect Zoo, and Keeping Bees. A complete index and a useful bibliography are supplied.

H. C. M.

Mr. Wizard's Science Secrets

• *By* DON HERBERT. Chicago: Popular Mechanics Press. 1952. Pp. 264. $3.00.

Here is a group of experiments for very young scientists, "magical" tricks selected by Don Herbert from the many he has demonstrated in his successful TV show "Watch Mr. Wizard." Using simple and inexpensive household materials, Mr. Herbert tells youngsters how some 150 mystifying tricks can be performed safely. Then he explains in simple language the secret "why" of what happened. Descriptions are clarified by simple line drawings of the apparatus used. There are a number of pertinent photographs and a foreword by Dr. Wilbur L. Beauchamp, professor of education at the University of Chicago. Teachers in the elementary grades will welcome this book. It will stimulate them not only by what it states but by what it suggests. Mr. Herbert is a good teacher.

H. C. M.

Development of the Guided Missile

• *By* KENNETH W. GATLAND. New York: Philosophical Library. 1952. Pp. X + 133. $3.75.

This book of modest size contains much interesting information about the evolution, present status, and future development of guided missiles, probably as much as the British Ministry of Supply will permit to be published at the present time. British interest in such weapons both for offense and defense is keen, since Britain would be an important and vulnerable target should a new World War erupt in Europe. Here are accounts of air-to-air missiles, supersonic rockets, rockets for high-altitude research, space-satellite vehicles, and a discussion of interplanetary flight. Rather technical, but not too difficult reading. There are 45 photographs and diagrams and an excellent table in which is summarized all the information on powered missiles currently available.

H. C. M.

Arctic Solitudes

• *By* ADMIRAL LORD MOUNTEVANS. New York: Philosophical Library. 1953. Pp. XVI + 143. $4.50.

Antarctic explorer Lord Mountevans has collected together in this beautifully illustrated book a number of stirring stories of man's adventures in the Arctic wastes searching for the Pole and for North-East and North-West Passages. The writer's keen awareness of the difficulties the explorers encountered and the danger they faced is apparent throughout. Here is good reading for an evening.

The account begins as far back as 983 A.D. with the arrival in Greenland of Eric the Red, and carries on to the present. Considerable space is devoted to the distinguished Sir John Franklin, who sacrificed his life in completing the discovery of the North-West Passage (1847-48). The 39 relief expeditions sent out in the vain hope of rescuing the party stimulated an American interest in Arctic exploration that has never waned. Lord Mountevans is open in his admiration of Robert E. Peary's skill as an explorer and of his ability to live off the land. He gives due consideration

(Continued on Page 76)

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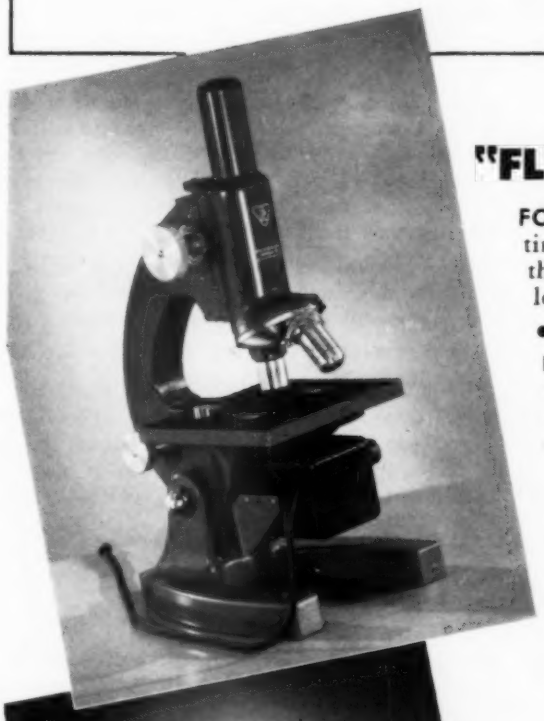

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A Desert Island in the Arctic

(Continued from Page 51)

plants, some of them, like the arctic poppy, very delicate looking.

Altogether there is little sand. A few strips along the beaches here and there where the oysterleaf sprawls like a blue star.

The salt marsh that borders almost all the strandlines with a thin red border expands over large surfaces on the silted inlets and flats. The fine marl is covered in places quite densely with the redleaved goosegrass. The scraping ice tends, however, to tear this carpet, to shred its edges, or even in many places to wipe it clear off the surface of the oozing soil. Scattered throughout are the rosettes of scurvygrass, their flat leaves gray against the gray mud.

Low, saturated ground is quite extensive. Overlying the gravel is a layer of marl, on top of which a good deal of decayed organic matter is mixed in with the finer sediments. Six different kinds of mosses cover much of the surface here where they form a swelling cushion. Arctic cotton a yellow-flowered saxifrage, and several other flowering plants occur as tufts and sprigs. A typical arctic grass (Dupontia) is, however, the most abundant plant, although its gracile culms and short thin leaves occupy very little space. Another arctic grass (Pleuropogon), which is not so common, has flat purple spikes that flow in the wind like pennants.

The most highly developed type of vegetation on this island is a kind of heath which willow and mountain avens dominate, their robust, gnarled twigs crowding and spreading above a green matrix of mosses. The crust-like snow-lichen seems to lie very lightly on the surface where it forms rather large patches in many places.

In spite of its presumably recent origin, Bray Island harbours a well consolidated vegetation, although not as well developed as on the mainland where the true heaths (bilberry, bearberry, arctic heather) are to be found. Nevertheless, the soil is in a fairly advanced stage of development. Most remarkable is the accumulation of decayed plant material. Because of the coarseness of the gravel and the wetness of the marl, the summer winds deposit rather little sand or other minerals on top of the soil (as they evidently do on the mainland). To this is also added a provision of nutrients by the seaweeds. They are deposited on the beaches in large quantities by the high tides. They form messy heaps, mostly whitish and red, giving the impression of soiled bandages. They dry and are blown inland where they become incorporated in pond, marsh, and heath.

The ice-cold ponds are full of life. Three or four different kinds of shrimps, one of them a bright vermilion, swim and pulsate vertiginously. Flocks of ducks and a couple of loons swim about in a leisurely way.

But now we must go. The fog has lifted. The solid blue line of the mainland can be seen once more to the east. Large ice floes rush past the island in the strong drift of the current. We must taxi out among the boulders and then quickly rise above the surface before we reach the channel. Maury can do it. But he is calling us now. Off we go. The terns are veering, diving, and screaming more angrily than ever. ●

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Writing on the Sand

(Continued from Page 61)

stone. The base of the triangle at the top and that of the triangle at the bottom represent respectively the animal's head and tail which stick out at each end. If the reader thinks that the interpretation is somewhat far-fetched let him at least admire the drawing itself.

23. Here is something that seems worth while, but I must humbly confess that I was unable to grasp the full meaning, so I let it go at that.
24. A reed or sapling growing in the forest.
25. An eagle's nest at the top of a large tree.
26. The Muyombo of Mua-Tchissenge. The latter was The Great Chief of the Chokwés before the arrival of the white man. While Camuimba was tracing this design in the sand, he said softly to his neighbors, "This is one he (that is, I) will not be able to put on his paper!" In fact I had to beg him to do it over again and to execute it with much less speed.
27. Lastly here is a design which is called simply Kalunca, that is, *God*. It pictures the following legend (as told me by the artist):

"Once upon a time the Sun went away to pay his respects to God. He walked and walked until he found the road that led to God. He presented himself before God. God gave him a cock and said to him: 'Come to see me tomorrow before you depart.' As soon as he had withdrawn from God's presence, the Sun went to bed (set). The following morning at an early hour, the cock, which God had given him, crew. The Sun immediately rose and presented himself before God, and God said to him: 'I heard the crowing of the cock I gave you yesterday for your supper. That is good. You may go now, but present yourself here every single day.'

"This is why the Sun makes the rounds of the world and reappears every day.

"The Moon also went to pay a visit to God. She also received a cock which she kept during the following night. The next morning, as soon as the cock began to crow, she presented herself again before God, holding the cock under her arm. God said to her: 'You also have not eaten the cock I gave you yesterday for your supper. That is good. From now on come back to see me every twenty-eight days.'

"Is not this what the Moon still does even in our own days?

"Man in his turn went to pay a visit to God. He received a cock, but as he was very hungry after his

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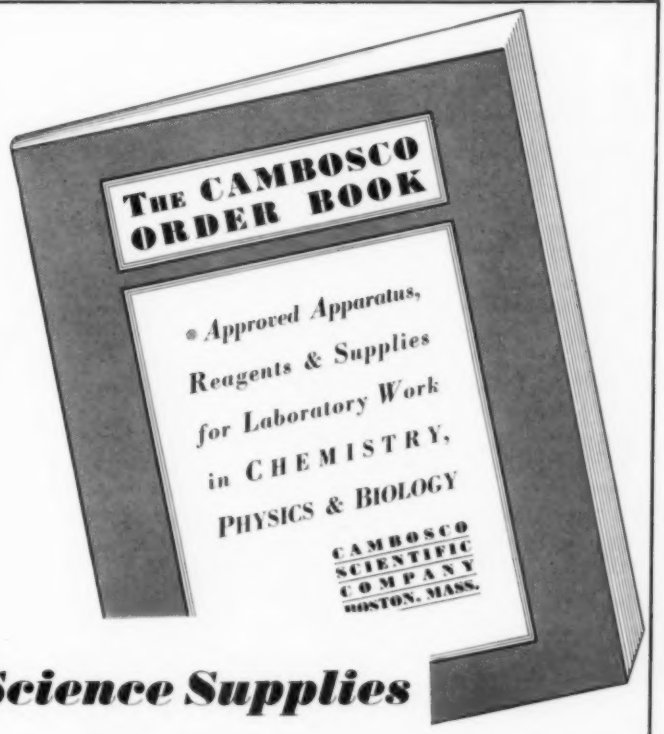
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Nature Therapy

(Continued from Page 42)

further discussion, but the usual limit was two programs on the same subject.

Outdoor field trips when weather permitted were an important feature. Sometimes, the first hour of our meeting time was held indoors, and the last hour was spent outdoors looking for material to illustrate the particular topic under consideration. The spacious hospital grounds with adjoining lake, fields, and woodlands, lent themselves admirably to field expeditions. Some patients were admittedly not especially interested in nature study, but they nevertheless welcomed the opportunity to be outdoors and away from their rooms; so field trips served a dual purpose. It was not surprising, however, to note that very often it was those professing non-interest who became most absorbed in the wonder of a killdeer performing its dramatic "broken wing" act to lure us away from its nest and babies . . . or to be intrigued with the discovery of a new bird or the history of a glacial boulder!

The patients allowed to attend the Club meetings were the women and men nearing recovery from their mental illnesses. Several were parolees who were allowed the freedom of the grounds. However, on the day that the use of a portable Spitz planetarium was very generously donated by the Worcester Natural History Museum, patients in other categories were allowed to attend. One hundred and fifty patients, with nurses and occupational therapists present, watched the wonders of the night skies portrayed on the big overhead dome. They asked many intelligent questions. During the entire time that this Nature Club project has been in action, there is no recollection, on my part, of very many foolish or unimportant questions being asked by patients. Questions have sometimes been too technical for me to answer, or they have often concerned subjects in which my knowledge was limited. In such cases the procedure was to admit that I did not know the answer, but would look it up and bring it to the next meeting. Observers told me that this factor seemed to be an important one to the patients. I was not a superior being who knew everything.

With the exception of the planetarium program, the average attendance at each meeting was twenty-seven. Attendance varied with the weather and other activities scheduled for the same two hours. The very first meeting brought out sixteen patients, but it was not too unusual, after that time, to find an audience of thirty-five to sixty patients waiting for me when other hospital activities did not conflict too much.

In checking with hospital authorities in the medical, recreational, and occupational therapy departments, the reports concerning the Nature Club are most favorable. The following points have been found to be important:

a. Nature Club meetings held the interest of the patients, and gave them something pleasant to look forward to.

b. Only patients in certain categories could attend the meetings; so, to be well enough to be allowed to go to Nature Club programs was a goal to strive for.

c. It meant a great deal to the patients to be trusted to go outdoors on field trips, especially near the lake, which is usually forbidden territory. This trust helped the patients to gain confidence in themselves.

d. From the point of view of the medical staff any activities which bring the patients outdoors are important, and the Nature Club programs aided in this respect.

e. Patients learned to take part in discussions, to relate experiences, and to ask questions. The hospital librarian reported that books on nature subjects were more in demand, books which had never before been taken out.

f. Nature Club programs provided a welcome break from regular hospital routine.

It is my sincere wish that all state hospitals could have such a project in nature therapy. An interest in our natural surroundings is a wholesome one for any person to have, and for mental patients it seems to be a helpful one. It can serve as an aid to recovery while the patient is hospitalized, and can well be carried over into normal life, beyond the hospital gates, to serve in a better understanding of the complex world around us. ●

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Science in Shirtsleeves

(Continued from Page 43)

immovable objects that would otherwise be available for study only to a few.

Thus far the visitor has seen a variety of materials transmuted to create the illusion of reality. Actual specimens rather than models or replicas are featured in the remaining exhibits of preparatorial skills. Joseph Yarmer, a specialist in the fine art of scientific chiseling, exhibits fossil bones as received from the field and in three stages of preparation, from a specimen surrounded by its rock matrix to one completely worked out and ready for study or exhibition. Insect-fanciers can learn some tricks of the trade from John Bauer's exhibit showing how to capture, kill, transport, and mount fragile moth and butterfly specimens. In another panel prepared by the Section of Insects and Spiders are examples of Lepidoptera received from all over the world during the single year 1952, while a third is devoted to life-cycle sequences and studies in contrast between large and small specimens. For visitors who want to know how a bird is skinned, Roland Hawkins has arranged a series of color photographs illustrating the principal stages in the process as carried out during a recent Museum expedition to Central America. A completed scientific birdskin accompanies this demonstration of jungle taxidermy.

The wall exhibits of Museum artists' work are as interesting for the differences they reveal in personality and interpretation as for disclosing processes ordinarily hidden from view behind studio doors. Chief Staff

Artist Ottmar von Fuehrer, who came to Carnegie Museum in 1922 after serving as staff artist for the Vienna Museum of Natural History, has made a lifelong specialty of dioramas both flat and three-dimensional. In the current show he exhibits life sketches, anatomical studies, and cartoons for two gigantic murals—one a recently completed Ice Age landscape with figures, and one now in process on a ninety-foot canvas that will revolve slowly past a viewing aperture in the Museum's new Cenozoic exhibition illustrating the evolution of mammals over a span of sixty million years. Wildlife studies of birds and beasts are shown on the opposite wall by Charles L. Ripper, Staff Illustrator, now on leave of absence with the Army, while Assistant Staff Artist Jay Matternes exhibits animals in action drawn from life and from memory. Clifford J. Morrow, Jr. contributes examples of spot drawings, poster designs, and page layouts for publications produced since he came to the Museum as Staff Artist a year and a half ago.

MUSEUM BACKSTAGE is only one among many signs of a rapprochement between institution and public that has attracted much favorable attention outside as well as in Pittsburgh these past few years. During the extensive renovations begun by Museum Director Wallace Richards after his appointment in 1948, it was discovered that changes under way interest visitors as much as the completed displays. Wherever possible, therefore, structural remodeling and mounting of new exhibits have been left open to public inspection, with a resulting intimacy of contact reflected in greatly increased attendance. Not content with putting laboratories on exhibition and bringing sidewalk superintendents indoors, Carnegie Museum is continually seeking further opportunities to build closer relationships with the people for whom it was founded, in the belief that a museum must be an organic member of its community and that education works both ways. ●

PREPARATORIAL TECHNIQUES in plaster and rubber. Right and upper left, reproductions of natural objects made with liquid latex, a method pioneered by Carnegie Museum. Lower left, plaster mold and head of woman used in recent exhibit of Chinese textiles.

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American Free Enterprise

(Continued from Page 62)

its counsel, and other coal experts. The six Germans represented the German Mine Workers Union, the Textile Employers Association, German labor unions, the Metal Workers' Union, German labor law, and German government employees.

Preceding the arrival of the Germans, were the visits to the USA of a group of sixteen members of a United Kingdom coal management and labor group. These British experts made an extensive study of our coal mining industry. Their report, later published by the Anglo-American Council on Productivity, emphasized, among other things, the following of their "findings": (1) the driving spirit of American coal people, and the adventurous spirit of our engineers and how they have mechanized coal mining to achieve output at lower costs; (2) the constant emphasis in America on new developments and techniques—we never seemed satisfied with current performance, and were always trying to do a better job; (3) the excellence of the way in which our personnel is trained and supervised.

In 1951, twelve Japanese experts representing what might here be called a National Labor Relations Board, came on their American mission to study American industry, and especially our coal mining methods. They wanted to learn how free men work here under our free enterprise system, wherein competition stimulates productivity, and how we can produce without the use of so-called "cartels" which exist abroad. In addition to the Japan Federation of the Coal Miners' Union, these officials represented the metal industry, chemicals, silk production, steel, spinning mills, the Japanese Ministry of Labor, and various management and employee organizations.

A while ago 14 Austrian coal miners visited this country under the Mutual Security Program. A Pennsylvania newspaper devoted a page of pictures and text to describing their amazement at the unbelievable living standards enjoyed by the American miners.

The Austrians couldn't believe at first that all the cars they saw parked near the pits belonged to the miners. They were astounded at the comforts and luxuries, ranging from refrigerators to TV sets, they saw in miners' homes. They were amazed to find that all you had to do to get hot water in one of these homes was to turn a faucet.

When an interpreter told them that the average American miner earned over $18 a day the Austrians assumed he had made a mistake—that the $18 was for a full week's work. They were dazzled by the welfare and retirement benefits our miners receive. And when the president of the coal company they were visiting passed by and said hello to a group of miners they thought they'd seen a miracle of democracy. It seemed even more miraculous when the president said, "Of

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course I speak to them. They're my friends. I play cards with them." It's still pretty much the rule in Europe that bosses are bosses and workers are workers and never the twain shall meet.

The Austrians saw something that too many Americans overlook. Under free enterprise—the much reviled capitalist system—labor has made the greatest gains in all history. ●

★ ★ ★ ★ ★

Industry Cooperates

(Continued from Page 52)

ful or important. We have gained a keen appreciation of the high school teacher and his problems. We also know how much he benefits if he is fortunate enough to secure one of these fellowships for he returns to his school system as a revitalized teacher with tremendously increased self-respect and renewed respect for his profession. We have wholeheartedly recommended the program's continuance at the conclusion of each summer's program."

Dr. Edwin Brown Allen of Rensselaer Polytechnic Institute summed up the aims of the mathematics program established there last year as:

"1. To stimulate enthusiasm for courses in mathematics on the part of teachers, and through them, on the part of students and officers of public instruction.

"2. To familiarize teachers with some of the important applications of mathematics.

"3. To furnish teachers with mathematics information which may be of assistance in their teaching and in the guidance of their students.

"4. To foster growth in the mathematical knowledge and background of the participants.

"5. And, in general, to aid these teachers in every possible way to make their secondary school mathematics courses of vital interest to the students.

"This brief outline must, of necessity, leave untouched many facets of the General Electric Mathematics Fellowship program but perhaps it is sufficient to indicate the interest of the General Electric Company in problems of education and its willingness to assist in solving them. To us, as mathematicians, it should be a source of encouragement to know that our science is recognized as of prime importance by a leading industrial organization."

Here is what one of the teachers wrote back:

"I often reflect on the six weeks with sheer pleasure. They were among the happiest of my life. The exciting and fascinating experience of the GESF is still vivid. My appreciation heightens as school opening approaches and I think of the new ideas that I have with which to introduce my students to the marvelous fields of science."

Another reported, "It was an education not purchasable at any other place in the country." And still another: "It was packed with experiences that will

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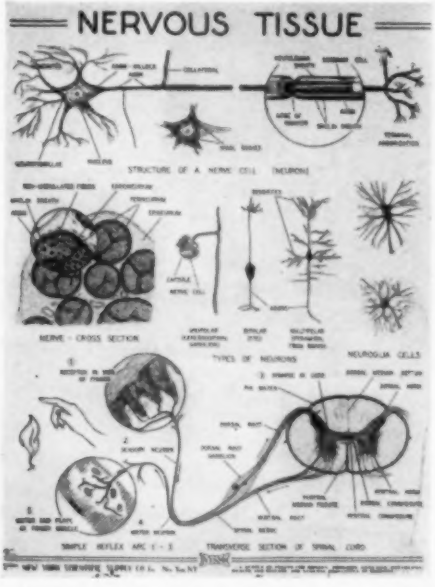

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enrich not only my teaching but my own life as well for many years to come. It was one of the most vitalizing experiences I have ever had."

From one of the more recent teachers came this word:

"I have always been convinced of the values of mathematics but now I find it easier to convince the students of them too."

The entire program has received widespread national recognition as an outstanding contribution in the improvement of high school instruction.

Half the states in the nation as well as the District of Columbia will be represented by the 200 teachers selected to take the program this summer.

Applications for the Case and Purdue courses are accepted from Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio, West Virginia and Wisconsin. Physics teachers will be eligible for consideration for the Case fellowships, and mathematics teachers from the area will be chosen for the Purdue fellowships.

Applications for Union fellowships are considered from science teachers in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina and the District of Columbia.

Mathematics teachers considered for the Rensselaer fellowships come from Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia and the District of Columbia.

General Electric sponsors this program not only as a good investment for itself but also for the nation, in terms of helping to maintain an adequate supply of better-than-average trained manpower. It is only one of many such G-E efforts to spur education. Probably the Company's best known program is the "House of Magic" science show, seen by millions of school pupils during the past 25 years. Millions of comic-type books of interesting facts about the every-day world are furnished annually by G-E upon request from teachers and its many educational films are in constant use by schools and colleges.

The Company is also providing 100 scholarships of $500 each this year to college juniors to assist them to complete their senior years. It is granting 70 scholarships of $500 each to employees and children of employees, and 35 fellowships for post-graduate study, in addition to a number of loans to employees and children of employees to assist them to continue their education.

Its aid to education includes scores of training programs within the Company to help employees make their work easier and to prepare them for better positions above their present jobs. ●

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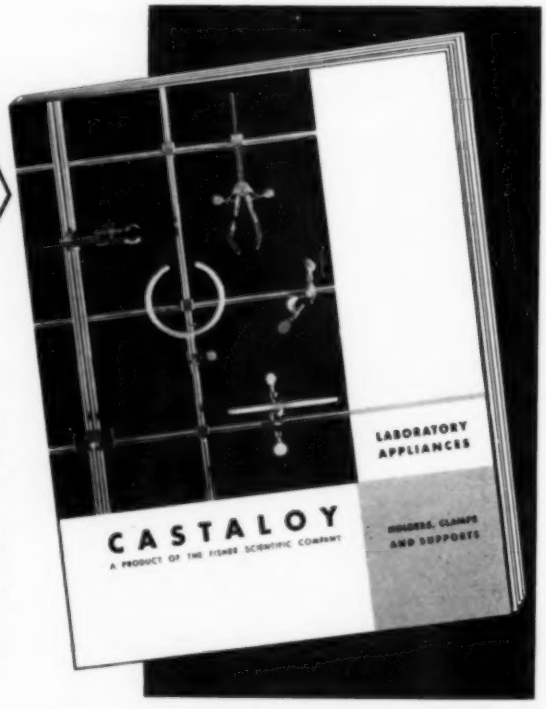

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Writing on the Sand

(Continued from Page 66)

long journey, he killed the cock and ate half of it that very night and saved the other part for his return journey.

"The following day, when the Sun was already high in the heavens, Man woke up. He ate what remained of the cock and then went to say goodbye to his divine Host.

"God said to him with a smile: 'What about that cock I gave you yesterday evening? I did not hear him crow this morning.'

"Man began to have great fear. 'I was very hungry,' he replied, 'I killed the cock and ate half of it last night and the other half I ate this morning because I wanted strength for my return journey.'

"'Very well, very well,' answered the Eternal. 'The cock was yours, but listen now to me: You know that the Sun and the Moon also paid me a visit. Each received a cock just as you did, but neither of them killed the cock. That is why neither the Sun nor the Moon will die. But you who have killed the cock, will die like the cock. And when you come to die, you will then come back and present yourself to me once more.'

"You realize that all this is very true: The Sun and the Moon continue to live, on and on—as in the time of our great-grandfathers. But Man dies—don't we all have to die?"

In the drawing, the sign at the top represents Kalunca (God); the sign at the bottom signifies Man; the Sun is marked at the left and the Moon at the right. The vertical line which connects the central dots represents the Road That Leads to God. ●

★ ★ ★ ★ ★

It may well be the case that the world needs more progress in the relations between individuals, groups, and nations than it does in the physical condition of man; who dares to say that the world needs scientific progress more than ethical progress? But the physical condition of man can be improved only if the fruits of science are produced; hence, every individual has a stake in scientific progress. We return full cycle to the thesis that the greatest need in scientific education is a programme of teaching what science is and what science does and how it affects the lives of each of us, what science can do and what it cannot—in other words "understanding science."

—I. BERNARD COHEN
Harvard University

★ ★ ★ ★ ★

The teacher must have a positive liking for young people. He must take pleasure in helping them to grow. No one is fit to teach who does not take positive delight in dealing with youth.

—WILLIAM HEARD KILPATRICK

Chocolate -- 1492 to 1953

(Continued from Page 58)

in the astringency and the formation of the parent constituents which will later, during roasting, give rise to the typical chocolate flavor and aroma.

Chemical changes taking place during roasting play an important part in flavor development. Chemical decomposition takes place, producing new and aromatic substances which are important components of the complete chocolate flavor. Dehydration, oxidation, and solubility changes take place in the tannins and bitter astringent substances. Unpleasant volatile materials, including hydrocarbons, ketones, volatile acids (butyric, acetic), pungent organic bases, and amine products of protein, are driven off. Any lipase present which would cause fat instability is destroyed. Water, of course, is lost and starch dextrinized, the latter contributing to the definite increase in water soluble matter after roasting. The bean loses any last trace of gumminess, becomes dry and brittle and of such a nature that it can be easily ground.

Probably the most subtle and least understood chemical changes take place during the conching of both sweet chocolate and milk chocolate. This action, although mild, is prolonged and serves to improve the flavor by removal of unpleasant volatile acids and other organic substances and by final oxidation of astringent tannin substances. Moisture content is further reduced and fluidity increased. At somewhat elevated temperatures, a definite but very mild caramelization may be achieved, producing distinctive flavor effects. Thus, conching brings about the final chemical changes in the chocolate.

Chocolate in whatever form it reaches the consumer, is almost universally popular. It is delightful to the taste and pleasing to people of all ages. We know it both as a confection and as a food. As a confection it is usually eaten for pure enjoyment; yet as a nutritious food it is given top rating by athletes, explorers, and soldiers, all of whom recognize its high energy value and remarkable sustaining properties. Nature has given to mankind one of her genuine blessings in the seeds produced by the cacao tree. "Theobroma cacao," the botanical name chosen for this product by the great Swedish scientist, Linnaeus, means "cocoa, the food of the gods." There are many who feel that this name is exceedingly well chosen. ●

★ ★ ★ ★ ★

All permanent advances in science are discoveries of relations between phenomena, and the factor in science that shows a steady uninterrupted growth is the extent of the field of related observations.

—HERBERT DINGLE
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Conservation of Vision

(Continued from Page 56)

condition may be started before the child is a year old. It should be completed before the child reaches school age.

The results of various research studies indicate that roughly 25 per cent of school children have visual defects severe enough to need correction. A yearly vision test is important since refractive errors and eye diseases may develop at any time during life. The vision tests approved for use in schools by the Commissioner of Education in New York State are those recommended for school screening purposes by the Council on Physical Medicine and Rehabilitation of the American Medical Association. The school nurse-teacher is usually responsible for the testing program but since many eye defects are discovered by a child's mannerisms while doing close work, the teacher's knowledge of the eye conditions and her cooperation in the discovery program are essential. The teacher can often be of help to the nurse in health education programs with parents and children in order to secure the needed medical follow up.

About one in every 500 school children is severely handicapped by an eye defect. Often times such children will find school work in the regular class a real hardship. An attempt to meet the needs of these children is made by the New York State Education Department in offering financial aid and other special services to school districts where such visually handicapped children are enrolled in limited vision classes. The schools seek further aid in the education of these children by consulting with the attending ophthalmologist or optometrist so that they will have a better understanding of the physical and visual limitations of the particular eye condition.

Eye accidents are all too common in spite of safety devices and legislation to bar the sale of dangerous toys and weapons. In this State it is a misdemeanor for a parent to allow a child under sixteen years of age to own an air or spring gun. The law also makes it a misdemeanor for a merchant to sell such articles to a minor.

There are many sharp objects common in every home that are a threat to vision. Scissors, ice picks, darts and knives to mention a few. Even a drinking glass when a little child is holding it to drink is a hazard to his eyes. If a toddler must drink while he is walking around, a plastic or tin cup is recommended.

If an eye is injured, no matter how slightly, immediate medical attention is a "must." Doctors tell us that often the success of the medical treatment of an injured eye is dependent upon the time at which the treatment is instituted.

Light is important to vision, for without it even the most perfect eye cannot see. It is a common misconception that using the eyes in poor light will tend to make them defective. Often poor light is thought to be the cause of a person's need for glasses. Suffice it to say that insufficient light for any visual task will cause the work to be a hardship resulting in undue fatigue.

The quality of illumination is a factor to be considered. Glare, from shiny surfaces or bright sources of illumination within the field of view, is disturbing and can produce eye fatigue as well as physical fatigue. Walls, floors, ceilings and other surfaces should be light colored in order to diffuse the light in the room. When reading, one should be comfortably seated with adequate light evenly distributed over the entire room. Reading in bed is not frowned upon if one maintains good posture and provides the proper illumination. Good illumination is important in schools because it promotes visual efficiency and physical comfort.

Our way of life is changing almost daily, and with the changes we find that there are greater and greater demands upon the special senses. Our schools have a part to play in helping children to be aware of the need for protection of these senses. All that favors and promotes general health helps to keep the eyes healthy and enables them to function effectively. ●

★ ★ ★ ★ ★

At the Sign of the Turtox

(Continued from Page 48)

men), gorillas, orangutans, beavers, bears, seals, sloths, giant pandas, leopards, and practically all of the smaller mammals native to North America.

In the Museum Preparations Department every type of skeleton is produced. Specimens can be found in almost any stage of preparation, from the carcass, ready for defleshing, to the completely mounted skeleton. It occasionally happens that entire horses and cows must be made into skeleton mounts. Recently, the Lincoln Park Zoo elephant appeared on the sick list and gave the osteologists of the staff some anxious moments! The new line of Turtox Rubber Models is on display here, and one may see all sorts of interesting biological demonstration mounts. Very attractive museum and specimen jar preparations of specimens literally line the shelves of the department. (To supplement the study of actual specimens, Turtox publishes five series of original explanatory charts and biological drawings, comprising more than 350 different subjects, many of which are available as Key Cards and Quiz Sheets.)

The Plastics Division produces all kinds of specimen embedments in crystal-clear plastic (Turtox Embedding Plastic). It is intriguing to watch these blocks emerge with a brilliant polish from the grinding room. The value of plastic embedments lies primarily in the permanence given to fragile or rare specimens. They also make possible a beautiful demonstration of life histories and composite mounts.

The Live Materials Department boasts cultures of delicate algae growing on a year-round basis in special air-conditioned and artificially lighted laboratories. There are many tanks and terraria of specimens including lichens, mosses, ferns, insectivorous plants, orchids, cacti, and a great variety of aquarium plants. The visitor is given an opportunity to see the important fruit fly strains and to examine some of the numerous protozoan cultures under the microscope. The department stocks laboratory animals, amphibians, bacteria cultures, and many other forms.

The Microscope Slide Department consists of a surprising number of independent divisions: botany, embryology, histology, parasitology, zoology, and preserved botany, each of which is staffed by its own specialists. One may ask to see some of the many slides Turtox is famous for, and enjoy their quality under a microscope. The various steps of micro-technique can be observed here at almost any time of the day. The Microscope Slide Department also stocks an immense variety of Kodachrome nature photographs, Kodachrome photomicrographs, and lantern slides.

The Apparatus Department is severely pressed for space because of large stocks and varieties of glassware items, instruments, collecting equipment, optical goods, and chemicals. Field and laboratory equipment are obtainable here for almost any purpose.

In the background, not apparent to visitors, is the Research Division which exists solely for the purpose of improving and developing new items. This division is largely responsible for the establishment of controlled algae cultures, biological rubber models, the introduction of plastic embedding, and the operation of the photomicrographic laboratory. Other forces, the office with all its ramifications, the Shipping Department, and the various production divisions all combine their efforts to give service in the Turtox tradition. ●

★ ★ ★ ★ ★

New Books

(Continued from Page 64)

to Nansen, Stefansson, Rasmussen and Amundsen. The work in the Arctic of the Royal Canadian Mounted Police receives attention. There are interesting stories about Eskimos and their way of life, and about whaling and bear hunting. The final chapter deals with the conquest of the Pole by air.

H. C. M.

From Lodestone to Gyro-Compass

• *By* CAPTAIN H. L. HITCHINS and COMMANDER W. E. MAY. New York: Philosophical Library. 1953. Pp. 219. $4.75.

This non-technical book by two British naval officers will quickly disillusion the reader who may think all compasses are merely simple magnetic needles pivoted on points, and that a single type of compass will serve all purposes equally well. The writers tell an interesting story that ranges from the simplest of all direction finders to the most modern instrument. A first chapter dealing with the compass in legend and history prefaces a discussion of the earth's magnetism and the magnetic compass and its development in the 19th and 20th centuries. Then literally dozens of other kinds of instruments are considered, such as, the gyro-compass, the inductor compass, the sun compass, the sky compass and other types or modifications designed for use in ships of various sizes, air craft, tanks and other vehicles. There are 19 plates and 33 line drawings. Useful references are listed at the end of each of the 11 chapters. A book well worth its cost.

H. C. M.

★ ★ ★ ★ ★

Living *with* the Land

(Continued from Page 55)

further changes may be necessary to keep a permanent agriculture.

With an interest in the problem and use of information and help available, often within the school, much can be done to increase our knowledge of local conditions. Once the situation is clearly realized, learning to live with the land, and imparting this knowledge to the pupils, is but a logical, easy step that is readily accomplished. ●

FOR FURTHER READING

1. What is a Conservation Farm Plan? U. S. Department of Agriculture, Leaflet No. 249.
2. Classifying Land for Conservation Farming. U. S. Department of Agriculture, Farmers Bulletin No. 1853
3. Conservation of Natural Resources. By Guy-Harold Smith, 1950.
4. Soil Conservation. By Hugh H. Bennett.

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